

General Operations Manual

Falcon III / Magellan / X4
RAID Subsystems

Version 1.5 (10, 2006)

Firmware Revision: 3.48x

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About This Manual

This manual provides all of the necessary information that a system administrator needs to configure and maintain Falcon III / Magellan / X4 Fibre-to-SAS or Fibre- to-SATA RAID subsystems.

There are several other manuals that came with your RAID subsystem:

" Installation and Hardware Reference Manual:

For hardware-related information.

" RAIDWatch User's Manual

For the Java-based, GUI RAIDWatch manager providing remote and concurrent management of RAID subsystems.

" RAID Planning Guide

For RAID basic concepts, configurations and subsystem management. The order of the chapters is arranged in accordance with the steps necessary for creating a RAID array.

The terminal screen displays and the LCD messages may vary when using subsystems running different firmware revisions.

Chapter 1	Helps the user to understand the screen messages on the LCD display.	
Chapter 2	Gives step-by-step instructions on creating a RAID using the LCD keypad panel.	
Chapter 3	Teaches the user how to interpret the information found on the RS-232C terminal emulation.	
Chapter 4	Gives step-by-step instructions on how to create a RAID via the RS-232C session.	
Chapter 5	Includes all the Fibre Channel-specific functions implemented since the firmware release 3.12.	
Chapter 6	Provides the advanced options for the host and drive channel configurations including I/O queuing, number of LUNs, host loop, in-band, and disk access characteristics settings.	
Chapter 7	Shows how to supervise system operating and component	

	status.	
Chapter 8	Details various methods, either manual or automatic, for maintaining array data integrity.	
Chapter 9	Shows how to expand a configured array or logical volume.	
Chapter 10	Shows how to use the SMART-related functionalities.	
Chapter 11	Describes the detail for the AV optimization mode implementations.	
Chapter 12	Redundant Controller Functional description	
Appendix A	Lists the important firmware features supported with the firmware version, arranged in accordance with the latest firmware version as of press date.	
Appendix B	Teaches the user how to upgrade firmware and boot record.	
Appendix C	Lists all of the controller event messages.	

Revision History

• Rev. 1.5: revised chapter 12 and added a controller event.

Who should read this manual?

This manual assumes that its readers are experienced with computer hardware installation and are familiar with storage enclosures.

Related Documentations

- Installation and Hardware Reference Manual
- RAIDWatch User's Manual

These two documents can be found in the product utility CD included with your subsystem package.

Conventions

Naming

From this point on and throughout the rest of this manual, the Falcon III / Magellan / X4 series is referred to as simply the "subsystem" or the "system" and Falcon III / Magellan / X4 is frequently abbreviated as "ES."

Lists

Bulleted Lists: Bulleted lists are statements of non-sequential facts. They can be read in any order. Each statement is preceded by a round black dot "•."

Numbered Lists: Numbered lists are used to describe sequential steps you should follow in order.

Important information that users should be aware of is indicated with the following icons:



NOTE:

These messages inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help you avoid making mistakes.



CAUTION!

Cautionary messages should also be heeded to help you reduce the chance of losing data or damaging the system.



IMPORTANT!

The Important messages pertain to use the Falcon III / Magellan / X4 subsystem introduced in this manual.



WARNING

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously.

Software and Firmware Updates

Please contact RAID's support staff or visit RAID's support site at www.raidinc.com/support.php for the latest software, firmware and user manuals.

Problems that occur during the updating process may cause unrecoverable errors and system down time. Always consult technical personnel before proceeding with any firmware upgrade.



The firmware version installed on your system should provide the complete functionality listed in the specification sheet/user's manual. We provide special revisions for various application purposes. Therefore, DO NOT upgrade your firmware unless you fully understand what a firmware revision will do.

1

LCD Screen Messages

1.1 The Initial Screen

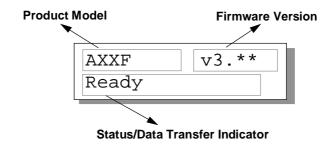


Figure 1-1: LCD Initial Screen

Status/Data Transfer Indicator:

Ready
There is at least one logical drive or logical volume mapped to a host ID/LUN combination.

No Host
LUN
Vet been mapped to any host ID/LUN.
Indicates the statistic of internal processing resources, not the host bus throughput. Each block indicates 256Kbytes of data being processed.

1.2 Quick Installation Screen

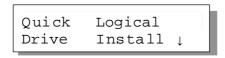


Figure 1-2: Quick Installation Screen

Press [ENT] to create a logical drive. The subsystem/controller will start initialization of one logical drive to include all connected disk drives and automatically map the logical drive to the first ID and LUN number of the first host channel. The "Quick Installation" can only be performed when there is no configured logical drive.

1.3 Logical Drive Status

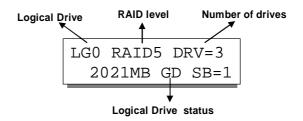


Figure 1-3: Logical Drive Status Screen

Logical Drive: The Logical Drive number.

RAID level: The RAID level applied for this logical

drive

Number of Drives: The number of physical drives included in

this configuration.

Logical Drive status:

XxxxMB The capacity of this logical drive.

SB=x Standby drives available to this logical

drive. Except the spares dedicated to other logical configurations, all spare drive(s) will be counted in this field, including

Global and Local Spares.

xxxxMB INITING The logical drive is now initializing.

1-2 RAID, Inc.

xxxxMB INVALID For firmware version before 3.31:

The logical drive has been created with "Optimization for Sequential I/O", but the current setting is "Optimization for Random I/O."

- OR -

The logical drive has been created with "Optimization for Random I/O," but the current setting is "Optimization for Sequential I/O."

Firmware versions 3.31 and later have separate settings for array optimization and array stripe size. This message will not appear when the optimization mode is changed.

xxxxMB GD SB=x The logical drive is in good condition.

xxxxMB FL SB=x One member drive failed in this logical

drive.

xxxxMB RB SB=x Logical Drive is rebuilding. xxxxMB DRVMISS One of the drives is missing.

INCOMPLETE Two or more drives failed in this logical

ARRAY drive.

1.4 Logical Volume Status

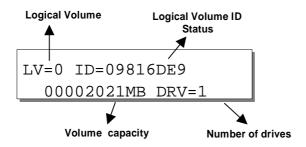


Figure 1-4: Logical Volume Status Screen

Logical Volume: The Logical Volume number.

DRV=x: The number of logical drive(s) contained

in this logical volume.

Logical Volume ID

Status:

The unique ID number of the logical volume (randomly generated by firmware). In MPIO applications, this ID can be used to identify a RAID volume connected through two separate host

links.

Logical Volume Status:

xxxMB The capacity of this logical volume.

1.5 Drive Status

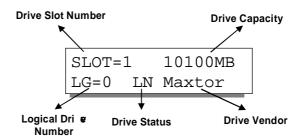


Figure 1-5: Drive Status Screen

Drive Status:

LG=x IN Initializing

LG=x LN On-line (already a member of a logical

configuration)

LG=x RB Rebuilding

LG=x SB Local Spare Drive
GlobalSB Global Spare Drive

NEW DRV New drive BAD DRV Failed drive

ABSENT Drive does not exist; an empty drive tray MISSING Drive missing (drive was once there)

SB-MISS Spare drive is missing

1-4 RAID, Inc.

1.6 Channel Status

Host Channel

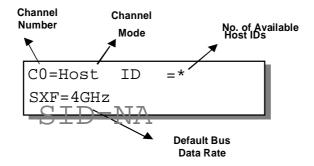


Figure 1-6: Host Channel Status Screen

Drive Channel (Single Controller Configuration)

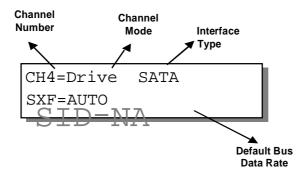


Figure 1-7: Drive Channel Status Screen

Channel Mode:

Host Host channel mode
Drive Drive channel mode

Default Channel Bus Sync Clock:

AUTO The default setting of this channel is

set to the automatic mode

1GHz, 2GHz, 4GHz Data rate can be manually configured

if the need arises

Available Host IDs:

Multiple IDs applied (Host channel

mode only)

(ID number) IDs are defined as AIDs (certainly not

referring to the virus here) or BIDs (Slot A or Slot B IDs). Slot A is the default location of the Primary

controller.

AIDs or BIDs facilitate the distribution of system workload between RAID controllers that reside in enclosure Slot A and Slot B. AIDs and BIDs can be associated with different RAID

volumes.

NA No ID applied



IMPORTANT!

For a single controller configuration, no IDs will be shown for a drive channel status screen. For a dual-active controller configuration, drive channels come with preset IDs.

1.7 Controller Voltage and Temperature

Press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Peripheral Dev," then press ENT.

Press the up or down arrow keys to select "Ctlr Peripheral Device Config..", press ENT and then choose

View and Edit Peripheral Dev

Ctlr Peripheral Device Config..

Device Status..

1-6 RAID, Inc.

"View Ctlr Periph Device Status..", then press ENT.

Press the up or down arrow keys to choose either "Voltage Monitor", or "Temperature Monitor".

Voltage Monitor

Temperature Monitor

Select "Temperature and Voltage Monitor" by pressing ENT. Press the up or down arrow keys to browse through the various voltage and temperature statuses.

[+12V] 12.077V Operation Normal

[+5v] 4.938v Operation Normal

[+3.3V] 3.384V Operation Normal

[CPU] 43.5°C in Safe Range

[+12v] 12.077v Operation Normal [CPU] 43.5°C in Safe Range

[Board1]46.5°C in Safe Range

[Board2]46.5°C in Safe Range

1.8 View and Edit Event Logs

Press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Event Logs," then press ENT.

View and Edit Event Logs

Press the up or down arrow keys to browse through the existing event log items.

UPS Power Failure Detected

To delete a specified item and all events prior to this event, press ENT for 2 seconds.

Press 2 Seconds to Clear Events



The event log will be cleared after the controller is powered off or reset.

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2

LCD Keypad Operation

A navigation roadmap for the configuration menu options of LCD keypad is separately available as a PDF file. You may check your Product Utility CD or contact technical support for the latest update.

2.1 Power On the RAID Enclosure

Before you start to configure a RAID system, make sure that hardware installation is completed before any configuration takes place. Power on your RAID subsystem.



NOTE:

- f If your Falcon III / Magellan / X4 RAID subsystem comes with dualredundant RAID controller modules, your subsystem's LCD panel can provide access to the operating status screen of the Secondary controller. However, in the dual- redundant configuration, only the Primary controller responds to user's configuration.
- f Each controller's operating mode is indicated by the flashing digit on the upper right of the LCD screen as "A" or "B." If the LCD displays "B," that means the LCD screen is currently displaying Slot B controller messages. Press both the Up and Down arrow keys for one second to switch around the access to different controllers.

2.2 Caching Parameters

2.2.1 Optimization Modes

Mass storage applications can be divided into two major categories according to its read/write characteristics: transaction-oriented and bandwidth-oriented. To optimize a subsystem for these two categories, two embedded optimization modes are available with system behaviors adjusted to different read/write parameters. They are the Optimization for Random I/O and the Optimization for Sequential I/O.

Limitations: There are limitations on the use of optimization modes.

- 1. System default is set to "Optimization for Sequential I/O."
- 2. You can select the stripe size of each array (logical drive) during the initial configuration. However, changing stripe size is only recommended for experienced engineers who have tested the effects of tuning stripe sizes for different applications.
- 3. The array stripe size can only be changed during the initial configuration stage before the array is put to use.
- 4. Once the controller optimization mode is applied, access to different logical drives in a RAID subsystem will follow the same optimized pattern.

Database and Transaction-based Applications:

These kinds of applications usually include SQL server, Oracle server, Informix, or other database services. These applications keep the size of each transaction down to the minimum, so that I/Os can be rapidly processed. Due to their transaction-based nature, these applications do not read or write a bunch of data in a sequential order, and that access to data occurs randomly. The transaction size usually ranges from 2K to 4K. Transaction performance is measured in "I/Os per second" or "IOPS."

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Video Recording/Playback and Imaging Bandwidth-oriented Applications:

This kind of applications usually includes video playback, video post-production editing, or other similar applications. These applications have the tendency to read or write large files from and into storage in sequential orders. The size of each I/O can be 128K, 256K, 512K, 1MB or more. The efficiency of these applications is measured in "MB/sec."

When an array works with applications such as video or image oriented applications, the application reads/writes from the drive as large-block, sequential threads instead of small and randomly accessed files.

The RAID subsystem firmware provides optimization modes that utilize the read-ahead buffer and other Read/Write characteristics tuned to obtain the best performance for these two major application categories. Although there are various applications and each requires different performance features, the two optimization modes should be sufficient for most application demands.

2.2.2 **Optimization Mode and Stripe Size**

Each controller optimization mode has preset values for the stripe size of arrays created in different RAID levels. If you want a different setting for a subsystem with configured arrays, you have to backup or move the stored data and re-create the arrays:

Step 1. Stop host I/O access.

Step 2. Move or backup all of your stored data in the subsystem.

Step 3. Change the optimization mode.

Step 4. Reset the subsystem.

Step 5. Re-create the array(s). Once the array(s) are created, stripe size cannot be changed.

Listed below are the default stripe sizes implemented with different optimization modes and RAID levels. These values should be sufficient for most applications:

Table 2-1 RAID Level, Optimization Modes, and Stripe Sizes

	Opt. for Sequential I/O	Opt. for Random I/O
RAID0	128KB	32KB
RAID1	128KB	32KB
RAID3	16KB	4KB
RAID5	128KB	32KB
RAID6	128KB	32KB
NRAID	128KB	32KB



Not every Falcon III / Magellan / X4 model supports RAID6 configuration.

2.2.3 Optimization for Random or Sequential I/Os



Every functional sub-menu displays with two periods ".." as the last digits. To access each configuration screen, press ENT once to change the last digits into a question mark "?". By then you will be able to use the arrow keys to display more options.

2-4 RAID, Inc. Step 1. Select from Main Menu "View and Edit Config Parameters ... "Caching Parameters ... Parameters," and press ENT.

Step 2. Choose "Optimization for Random I/O" or "Optimization for Sequential I/O," then press ENT for two seconds to confirm.

Step 3. Press ESC to leave and the Optimization for setting will take effect after Sequential I/O? the subsystem is rebooted.

The firmware default is Optimization for Sequential I/O.



IMPORTANT!

The original 512GB threshold on array optimization mode has been canceled. If the size of an array is larger than 16TB, only the optimization for sequential I/O can be applied. Logical drives of this size may not be practical; therefore, there is actually no limitation on the optimization mode and array capacity.

2.2.4 Write-back/Write-through Cache Enable/Disable

- Step 1. Select from Main Menu "View and Edit Config Parameters." "Caching Parameters." "Caching Parameters." Write-Back Cache
- Step 2. As one of the sub-menus in "Caching Parameters," this option controls the cached write function. Press ENT to enable or disable "Write-back Cache."
- Step 3. Press ENT for two seconds to confirm. The current status will be displayed on the LCD.



IMPORTANT:

- f The Write-through mode is safer if your subsystem is not managed by a controller pair and there is no UPS or battery backup.
- f Write-back caching can dramatically improve write performance by caching the unfinished writes in memory and let them be committed to drives latter in a more efficient manner. In the event of power failure, a battery module can hold cached data for days. In the event of controller failure in a dual-active configuration, data cached in the failed controller has an exact replica on its counterpart controller and therefore remains intact.

2.2.5 Periodic Cache Flush

If for a reason Write-Back caching is preferred for better performance and yet data integrity is of the concern, e.g., lack of the battery protection, the system can be configured to flush the cached writes at every preset interval.

Note that the "Continuous Sync" option holds data in cache for as long as necessary to complete a write operation and immediately commits it to hard drives if it does not come in a series of sequential writes.

Step 1. Select from Main Menu "View and Edit Config Parms," "Caching Parameters," and press ENT.

Period CachFlush Time - Disable

Step 2. Use the arrow keys to scroll through the options and select "Periodic CachFlush Time", and then press ENT to proceed.

Set Cache Flush Time - Disable

- Step 3. The "Set Cache Flush Time Disable" appears. The default is "Disable." Use your arrow keys to select an option from "ConSync," "30sec," to "600 sec." "ConSync" stands for "continuously synchronized."
- Step 4. Press ENT to select and press ESC to leave and the setting will take effect immediately.

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IMPORTANT!

- f Every time you change the caching parameters, you must reset the controller for the changes to take effect.
 - f In the redundant controller configuration, write-back will only be applicable when there is a synchronized cache channel between partner controllers.

2.3 View Connected Drives:

A RAID subsystem consists of many physical drives. These drives can be grouped into one or several logical configurations.

Step 1. Press the front panel ENT button for two seconds to enter the Main Menu. Use the up or down arrow keys to navigate through the menus. Choose "View and Edit Drives," then press ENT.

Use the up or down arrow keys to scroll down the list of connected drives' information screens.

You may first examine whether there is any drive installed but not shown here. If there is a drive installed but not listed, the drive may be defective or not installed correctly. Please check your enclosure installation and contact your system vendor.

Press ENT on a drive.
Choose "View Drive Information" by pressing ENT. Use the up or down arrow keys to navigate through the screens.

View Drive Information ..

The Revision Number of the selected drive will be shown. Press the down arrow key to see other information.

Revision Number: 0274

Other information screens include "Serial Number" and "Disk Capacity" (displayed in blocks; each block equals 512K Bytes).



IMPORTANT!

- f Drives of the same brand/model/capacity might not feature the same block number.
- f The basic read/write unit of a hard drive is a block. If members of a logical drive have different block numbers (capacity), the smallest block number will be taken as the maximum capacity to be used in every drive. Therefore, use drives of the same capacity so your investment is not wasted.
- f You may assign a Local/Global Spare Drive to a logical drive whose members have a block number equal to or smaller than the Local/Global Spare Drive but you should not do the reverse.

2.4 Creating a Logical Drive

To create a logical drive, press ENT for two seconds to enter the Main Menu.

Use the up or down arrow keys to navigate through the menus. Choose "View and Edit Logical Drives," and then press ENT.

Rep 2. Press the up or down arrow keys to select a logical drive entry, then press ENT for two seconds to proceed.

"LG" is short for Logical Drive.

2.4.1 Choosing a RAID Level

Press the up or down arrow keys to select the desired RAID level, then press ENT for two seconds. "TDRV"

(Total Drives) refers to the number of all available disk drives.

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2.4.2 Choosing Member Drives

Press ENT for two seconds; RAID 6 Selected the message, "RAID X selected To Select drives", will prompt. Confirm your selection by pressing ENT.

Step 5. Press ENT, then use the up or down arrow keys to browse through the available drives.

Step 6. Press ENT again to select/deselect the drives. An asterisk (*) mark will appear on the selected drive(s). To deselect a drive, press ENT again on the selected drive. The (*) mark will disappear.

SLOT=1 239367MB *LG=0 SL SEAGATE

Step 7. After all the desired drives have been selected, press ENT for two seconds to continue.

2.4.3 Logical Drive Preferences

Step 8. You may also choose "Change Logical Drive Parameter?"

Parameter," then press ENT to change related parameters before initializing the logical drive.

2.4.4 Maximum Drive Capacity

Step 8-1-1. Choose "Maximum Drive Capacity," then press ENT. The maximum drive capacity refers to the maximum capacity that will be used in each member drive.

Step 8-1-2. If necessary, use the up and down arrow keys to change the maximum size that will be used on each drive.

MaxSiz= 239367MB
Set to 239367MB?

Sometimes using a slightly smaller number here can be safer in case drive of the same size may actually feature different number of blocks.

2.4.5 Spare Drive Assignments

The Local (Dedicated) Spare Drive can also be assigned here.

Spare Drive Assignments

- Step 8-2-1. Press the up or down arrow keys to choose
 - "Spare Drive Assignments," then press FNT.
- Step 8-2-2. Available disk drives will be listed. Use the up or down arrow keys to browse through the drive list, then press ENT to select the drive you wish to use as the Local Spare Drive.

 Slot=* 239367MB New DRV SEAGATE

 Slot=* 239367MB *LG=0 SL SEAGATE
- Step 8-2-3. Press ENT again for two seconds.

2.4.6 Disk Reserved Space

This menu allows you to see the size of disk reserved space. Default is 256MB.

Disk Rev. Space 256MB ..

2.4.7 Logical Drive Assignment (Dual-Active Controllers)

If you have two controllers, you may choose to assign this logical drive to the secondary controller. The assignment can take place during or after the initial configuration.

Step 8-3-1. the redundant l controller function has been enabled, and the secondary controller IDs have been assigned to 1/0 channels, the assignment menus should appear as listed on the right.

Logical Drive Assignments ...

Red Ctlr Assign to Sec. Ctlr ?

17

Step 8-3-2. If you want to assign this logical drive to the

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Secondary controller. press ENT once the display question mark "?". Press again for two seconds to confirm the change.

2.4.8 **Write Policy**

This menu allows you to set the caching mode policy for this specific logical drive. "Default" is a neutral value that is coordinated with the subsystem's caching mode setting. Other choices are "Writeback" and "Write-through."

Write Policy Default

Write Policy Default

Step 8-4-1. Press ENT once to change the status digits into question mark "?".

Step 8-4-2. Use the arrow keys to select "Default," "Write-back," or "Write-through."

Step 8-4-3. Press ENT for two seconds to confirm your change.



IMPORTANT!

- The "Write-back" and "Write-through" parameters are permanent for specific logical drives. The "Default" selection, however, is more complicated and more likely equal to "not specified."
 - f If set to "Default," a logical drive's write policy is controlled not only by the subsystem-level caching mode setting, but also by the "Event trigger" mechanisms. The "Event Trigger" mechanisms automatically disable the write-back caching and adopt the conservative "Write-through" mode in the event of battery or component failures.

2.4.9 **Initialization Mode**

This menu allows you to determine if the logical drive is immediately accessible. If the Online method is used, data can be written onto it before the array's initialization is completed. Users may proceed with other array configuration processes, e.g., including this array in a logical volume.

Initialization Mode Online.. Array initialization can take a long time especially for those comprising large capacity. Setting to "Online" means the array is immediately accessible and that the controller will complete the initialization when I/O demands become less intensive.

Step 8-5-1. Press ENT once to change the status digits into a question mark "?".

Initialization Mode Online?

Step 8-5-2. Use the arrow keys to select either the "Online" or the "Off-line" mode.

Step 8-5-3. Press **ENT** for two seconds to confirm your change.

2.4.10 Stripe Size

This menu allows you to change the array stripe size. Setting to an incongruous value can severely drag performance. This item should only be changed when you can be sure of the performance gains it might bring you.

Stripe size Default ..

Listed below are the default values for an array. For each logical drive, the default value for the stripe size is determined by the Optimization Mode and the RAID level applied.

Table 2-2 RAID Level, Optimization Modes, and Stripe Size

	Opt. for Sequential I/O	Opt. for Random I/O
RAID0	128KB	32KB
RAID1	128KB	32KB
RAID3	16KB	4KB
RAID5	128KB	32KB
RAID6	128KB	32KB
NRAID	128KB	32KB

Step 8-6-1. Press ENT once to change Stripe size the status digits into a 128KB ? question mark "?".

Step 8-6-2. Use the arrow keys to select a desired stripe size.

Step 8-6-3. Press **ENT** for two seconds to confirm your change.

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2.4.11 Beginning Initialization

Press ESC to return to the previous menu. Use the up or down arrow keys to select "Create Logical Drive?".

Step 10. press ENT for two seconds to start initializing the logical drive.

The Online Mode:

If the online initialization method is applied, the array will be available for use immediately. The array initialization runs in the background and the array is immediately ready for I/Os. Engineers can continue configuring the RAID subsystem.

LG=0 Creation Completed!

The Offline Mode:

The RAID controller will immediately start to initialize the array parity if the "offline" mode is applied. Note that if NRAID or RAID0 is selected, initialization time is short and completes almost within a second.

Initializing090%
Please Wait!

LG=0 Initializat Ion Completed

The logical drive's information displays when the initialization process is completed. If the "online" mode is adopted, array information will be displayed immediately.

LG=0 RAID6 DRV=4 478734MB GD SB=0



NOTE:

Due to the operation complexity, the RAID Migration option is not available using the LCD keypad panel.

2.5 Creating a Logical Volume

Step 1. Press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Logical Volume," then press ENT.

View and Edit Logical Volume

Step 2. Press the up or down arrow keys to select an undefined entry for logical volume, then press ENT for two seconds to proceed. "LV" is short for Logical Volume.

LV=0 Not Defined

Step 3. Proceed to select one or more logical drives as the

LV=0 Selected To Select LD Drives?

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members of а logical volume. Press ENT proceed. "LD" is short for Logical Drive.

() Step 4. Use the up or down arrow keys to browse through the logical drives.

LG0 RAID5 DRV=3 2021MB GD SB=0

- Step 5. Press ENT again to select/deselect the members. An asterisk (*) mark will appear in front of a selected logical drive.
- Step 6. After all the desired logical drive(s) have been selected, press ENT for two seconds to continue.

Two sub-menus will appear.

2.5.1 **Initialization Mode**

Array initialization can take a long time especially for those comprised of large capacity. Setting to "Online" means the array is immediately accessible and that will controller complete initialization when I/O demands become less intensive.

Initialization Mode Online.

Step 7-1-1. Press ENT once to change | Initialization the status digits into a question mark "?".

Mode Online?

- Step 7-1-2. Use the arrow keys to select either the "Online" or the "Off-line" mode.
- Step 7-1-3. Press **ENT** for two seconds to confirm your change.

2.5.2 **Write Policy**

This menu allows you to set the caching mode policy for this specific logical volume. "Default" is a neutral value that is coordinated with the controller's caching mode setting. Other choices are "Write-back" and "Write-through."

Write Policy Default

Step 7-2-1. Press ENT once to change the status digits into a question mark "?".

Step 7-2-2. Use the arrow keys to select "Default," "Write-back," or "Write-through."

Step 7-2-3. Press **ENT** for two seconds to confirm your change.



IMPORTANT!

- f The "Write-back" and "Write-through" parameters are permanent for specific logical drives. The "Default" selection, however, is more complicated and more likely equal to "not specified."
 - f If set to "Default," a logical drive's write policy is controlled not only by the subsystem-level caching mode setting, but also by the "Event trigger" mechanisms. The "Event Trigger" mechanisms automatically disable the write-back caching and adopt the conservative "Write-through" mode in the event of a battery or component failure.
- **17** Step 8. When you are finished setting the preferences, press **ENT** for two seconds to display the confirm box. Press ENT for two seconds to start initializing the logical volume.

Lv=0 Creation Completed

Logical Volume ?

Create

Step 9. A message shows that the logical volume has been successfully created.

Create Logical Volume Successed

Step 10. Press ESC to clear the message.

Logical volume information will be displayed below.



NOTE:

f Once a logical drive is included in a logical volume, its "Controller Assignment" option will disappear. The members within a logical volume will then be managed by one controller. And the controller assignment option displays under the logical volume sub-menu.

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2.5.3 **Logical Volume Assignment (Dual-Active** Controllers)

If you have two RAID controllers, you may Change Logical choose to assign this logical volume to the Slot Volume Params B controller (Default is Slot A, the dominant controller). The assignment can take place during or after the initial configuration.

Logical Volume Assignments

If the redundant controller function has been enabled, and the secondary controller IDs have been assigned to I/O channels, the assignment menus should appear as listed on the right.

Red Ctlr Assign to Sec. Ctlr

If settings related to redundant controllers have Assignment not been completed, you may set them after the volume is successfully created.

Logical Volume

Step 1. Press ENT on a configured Red Ctlr Assign logical volume. Use arrow keys to Sec. Ctlr select "Logical Volume Assignment..", and press ENT to proceed. Press ENT for two seconds to confirm.

Step 2. Press ESC, and the LCD will LV=0 ID=685AE502 display the logical volume's 2021MB information when initialization is finished.

Partitioning a Logical Drive/Logical 2.6 Volume



IMPORTANT!

- Partitioning and the creation of logical volumes, ARE NOT requirements for building a RAID subsystem. The configuration processes for partitioning a logical drive are the same as those for partitioning a logical volume.
- Partitioning a configured volume will destroy all data stored on it.



WARNING!

Partitioning a configured volume will destroy all data stored on it.

Step 1. Press ENT for two seconds to enter the Main Menu. Press View and Edit the up or down arrow keys to Logical Volume select "View and Edit Logical Volume," then press ENT. Use the up or down arrow LV=0 ID=685AE502 Step 2. 2021MB DRV=1 keys to select a logical volume, then press ENT. Use the up or down arrow Partition keys to select "Partition | Logical Volume. Logical Volume," then press FNT. **17** Step 4. The total capacity of the Prt=1: LV=0logical volume will be 2021MB displayed as one partition. Press ENT for two seconds to change the size of the first partition. Step 5. Use the up or down arrow LV=0 Part=0: 2021MB keys to change the number of the flashing digit, (see the arrow mark) then press ENT to move to the next digit. Step 6. After changing all the digits, press ENT for two seconds to confirm the capacity of this partition. You may also use LV=0 Part=0: arrow keys to move down to 700MB the next partition to configure more partitions. LV=0 Partition=1 1321MB The rest of the drive space will be automatically allocated as the partition. You may go on to create up to 16 partitions using the same method described above.

Step 7. Press ESC several times to return to the Main Menu.

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IMPORTANT!

If operated with a Unix-based system, reset the subsystem for the configuration to take effect if any changes have been made to partition sizes and partition arrangement.

2.7 Mapping a Logical Volume/Logical Drive to Host LUN

The process of mapping (associating with) a logical drive is identical to that of mapping a logical volume. The process of mapping a logical volume is used here.

Step 1. Press ENT for two seconds to enter the Main Menu. Use the up or down arrow keys to select "View and Edit Host Luns." then press ENT.



IMPORTANT!

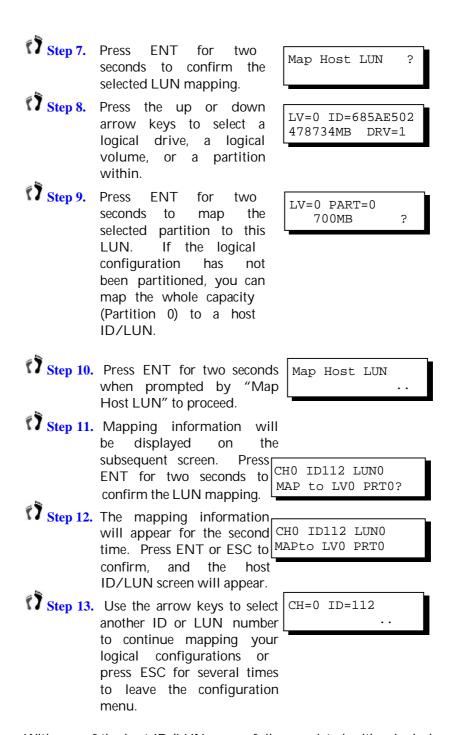
Note some details before proceeding:

Slot A/Slot B IDs: A logical group of drives (logical drive/logical volume) previously assigned to the Slot A controller cannot be mapped to a Slot B ID. Neither can those assigned to the Slot B controller be mapped to a Slot A ID.

- Step 2. The first available ID on the CH=0 AID=112 first host channel appears (usually channel0).
- Step 3. Press the up or down arrow keys to select a configured host ID, and then press ENT for two seconds to confirm.
- Step 4. Press the up or down arrow keys to select the type of logical Drive? logical configuration to be associated with a host ID/LUN. Available choices are "Map to Logical Drive" or "Map to Logical Volume".
- Step 5. Confirm your choice by pressing ENT for two seconds.
- Step 6. Press the up or down arrow keys to select a LUN number, then press ENT to proceed.

CH0 ID112 LUN0 Not Mapped

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With any of the host ID/LUN successfully associated with a logical capacity, the "No Host LUN" message in the initial screen will change to "Ready."

If you want to create more host IDs, please move to Section 2.12 Viewing and Editing Channels for more details on channel mode and channel IDs settings.

2.8 Assigning Spare Drive and Rebuild **Settings**

Adding a Local Spare Drive 2.8.1

Step 1. Press ENT for two seconds to View and Edit enter the Main Menu. Press Drives .. the up or down arrow keys to select "View and Edit Drives," then press ENT.

Step 2. Disk drive information will be displayed on the LCD. Press Slot=* 1010MB the up or down arrow keys to NEW DRV SEAGATE select a drive that is stated as "NEW DRV" or "USED DRV" that has not been included in any logical drive. specified as a spare drive or failed drive, then press ENT to select it.

Step 3. Press the up or down arrow keys to select "Add Loca Drive Spare Drive," then press ENT.

Add Local Spare

2012MB GD SB=0

Step 4. Press the up or down arrow LG0 RAID5 DRV=3 keys to select the logical drive where the Local Spare Drive will be assigned, then press ENT for two seconds to confirm.

Step 5. The message "Add Local Spare Spare Drive Successful" will be displayed on the LCD.

Drive Successful

Adding a Global Spare Drive 2.8.2

Step 1. Press ENT for two seconds to View and Edit enter the Main Menu. Press Drives the up or down arrow keys to select "View and Edit Drives," then press ENT.

Disk drive information will be Slot=* 1010MB displayed on the LCD. Press NEW DRV SEAGATE the up or down arrow keys to select a disk drive that has not been assigned to any logical drive, then press ENT.

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- Step 3. Press the up or down arrow keys to select "Add Global Spare Drive," then press ENT.
- Step 4. Press ENT again for two Add Global Spare seconds to add the spare Drive Successful drive. The message, "Add Global Spare Global Spare Drive Successful," will be displayed on the screen.

2.8.3 Adding an Enclosure Spare Drive

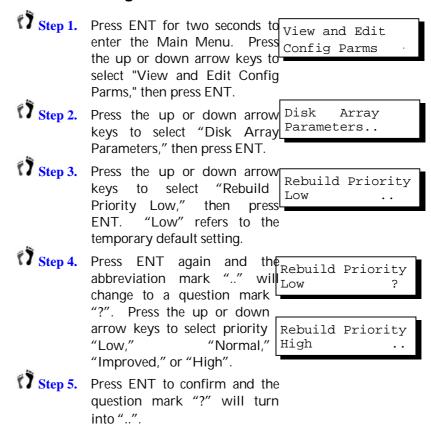
In environments where RAID volumes might span across several enclosures, e.g., using JBODs, this option can designate a spare drive to rebuild a failed drive within the same enclosure.

This option helps avoid disordered hard drive locations after one or more member drives have failed and been rebuilt.

- Step 1. To create an Enclosure Spare Drive, press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Drives," then press ENT.
- Step 2. Disk drive information will be displayed on the LCD. Press the up or down arrow keys to select a disk drive that has not been assigned to any logical drive, then press ENT.
- Step 3. Press the up or down arrow keys to select "Add Enclosure Add Enclosure Spare Drive," then press ENT. Spare Drive .
- When the last digit changes to a question mark "?", pressAdd Enclosure ENT again for two seconds to Spare Drive ? create the enclosure spare.

 The message, "Add Spare Add Spare Drive Drive Successful," will be Successful!!
- Step 5. Press ESC and the driveslot=0 239112MB status displays as shown on ENCLOS Maxtor 7 the right.

2.8.4 Rebuild Settings





NOTE:

The rebuild priority determines how much of the system resources are used when rebuilding a logical drive. The default setting of the rebuild priority is "LOW." Rebuild will have less impact on host I/O access, but will take a longer time to complete. Changing the priority to a higher level will achieve a faster rebuild, but will significantly increase the host I/O response time. The default setting "LOW" is recommended.

2.9 Viewing and Editing Logical Drives and Drive Members

Step 1. Press ENT for two seconds to View and Edit enter the Main Menu. Press the up or down arrow keys to select "View and Edit Logical Drives..." then press ENT.

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Step 2. Press the up or down arrow keys to select the logical drive, then press ENT.

Step 3. Press the up or down arrow keys to select "View Drives.", then press ENT.

Step 4. Press the up or down arrow keys to scroll through the list of member drives.

Step 4. Press the up or down arrow keys to scroll through the list of member drives.

2.9.1 Deleting a Logical Drive



WARNING!

Deleting a logical drive erases all data stored in it.

View and Edit Logical Drives the up or down arrow keys to select "View and Edit Logical Drives," then press ENT.

Step 2. Press the up or down arrow LGO RAID5 DRV=3 keys to select a logical drive, 2012MB GD SB=1 then press ENT.

Step 3. Use the up or down arrow keys to select "Delete Logical Drive," then press ENT.

Step 4. Press ENT for two seconds to delete. The selected logical drive is now deleted.

LG=0
Not Defined ?

2.9.2 Deleting a Partition of a Logical Drive

View and Edit
Logical Drives

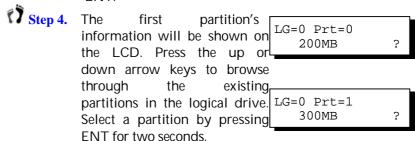
the up or down arrow keys to
select "View and Edit Logical
Drives...," then press ENT.

Step 2. Press the up or down arrow
keys to select a logical drive,
then press ENT.

Step 3. Press the up or down arrow
keys to choose "Partition

Partition
Logical Drive ...

Logical Drive," then press FNT.



Keys to change the number of the flashing digit to "0," then press ENT to move to the next digit. After changing all the digits, press ENT for two seconds.

The disk space of the deleted partition will be automatically allocated to the previous partition as diagrammed below. If partition 1 is deleted, its disk space will be added to partition 0.

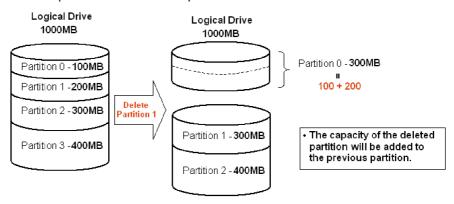


Figure 2-1 Drive Space Allocated to the Previous Partition



Whenever there is a partition change, data will be erased. Prior to partition change, you have to remove its associated host LUN mappings. After the partition change, you also need to re-arrange the disk volumes from your host system OS.

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2.9.3 Assigning a Name to a Logical Drive

Press ENT for two seconds to View and Edit enter the Main Menu. Press Logical Drives the up or down arrow keys to select "View and Edit Logical Drives..," then press ENT. Step 2. Press the up or down arrow LGO RAID5 DRV=3 keys to select a logical drive, 2012MB GD SB=1 then press ENT. Step 3. Press the up or down arrow Logical Drive keys to select "Logical Drive Name Name," then press ENT. Press the up or down arrow Enter LD Name: keys to change the character of the flashing cursor. ENT to move the cursor to the next space. The maximum number of characters for a logical drive name is 14.

2.9.4 Rebuilding a Logical Drive (Manual Rebuild)

If you want the controller to auto-detect a replacement drive, make sure you have the following options set to enabled:

- 1. Periodic Drive Check Time
- 2. Periodic Auto-Detect Failure Drive Swap Check Time

These two configuration options can be found under "View and Edit Configuration Parameters" -> " Drive-Side Parameters".

A manual rebuild takes place after you replace the failed drive with a new/used drive that is known to be good.

Step 1. Press ENT for two seconds to enter the Main Menu. Press the up or down arrow keys to select "View and Edit Logical Drives.", then press ENT.

Step 2. Use the up or down arrow keys to select the logical drive

that has a failed member, then press ENT.

Use the up or down arrow keys to select "Rebuild Logical Drive," then press

Rebuild Logical Drive

ENT.

(7) Step 4. Press ENT for two seconds to start rebuilding the logical drive.

Rebuild Logical Drive

The rebuilding progress will LG0 RAID5 DRV=3 be displayed (in percentage on the LCD. When rebuild is already started or the logical drive is being rebuilt by Local/Global/Enclosure Spare Drive, choose "Rebuild Progress" to see the rebuild progress.

Rebuilding 25% Please Wait!

2012MB RB SB=0

Rebuild Progress



IMPORTANT!

- The Rebuild function will appear only if a logical drive (with RAID level 1, 3, 5 or 6) has a failed member.
- f Carefully verify the physical location of a failed drive before replacement takes place. Removing the wrong drive may cause a logical drive to fatally fail and data loss is unrecoverable.

2.9.5 Regenerating Logical Drive Parity

If no verifying method is applied to data writes, this function can be manually performed to ensure that parity errors can be mended.

From the Main Menu, press View and Edit the up or down arrow keys to select "View and Edit Logical Drives."

Logical Drives

N Step 2.

If you have more than one logical drive, use the up or down arrow keys to select the logical drive you would like to check the parity for, and then press ENT.

LG0 RAID5 DRV=3 4095MB GD SB=0

Regenerate

Parity

(7) Step 3. Before execution the command appears, there are

2-28 RAID. Inc. two option screens that allow you to control the parity check operation:

Overwrite when Inconsistency ..

Events On when Inconsistency ..

The "Overwrite" option determines whether the inconsistent data blocks should be automatically recovered or only marked as bad.

The "Events On" option determines whether to issue an event message if inconsistencies should be discovered.

Step 4. Press the up or down arrow Execute keys to select "Execute Parity Check".

Check" and then press ENT.

Step 5. To stop the regeneration Abort Regenerate process, press ESC and enter the submenu to select "Abort Regenerate Parity".



IMPORTANT!

If the Parity Regenerating process is stopped by a drive failure, the process cannot restart until the logical drive is rebuilt.

2.9.6 Media Scan

Media Scan is used to examine drives and detect the presence of bad blocks. If any data blocks have not been properly committed, data from those blocks are automatically recalculated, retrieved, rewritten or stored onto undamaged sectors. If bad blocks are encountered on yet another drive during the rebuild process, the block LBA (Logical Block Address) of those bad blocks will be listed. If rebuild is carried out in this situation, rebuild will continue with the unaffected sectors, salvaging a majority of the stored data.

Step 1. From the Main Menu, press View and Edit the up or down arrow keys to Logical Drives select "View and Edit Logical Drives".

first logical drive | LGO RAID5 DRV=3 displays. If you have more 4095MB GD SB=0 than one logical drive, use the up or down keys to select the logical drive you want to scan, and then press ENT. Step 3. Press the up or down arrow Media Scan keys to select "Media Scan" and then press ENT. Step 4. Press ENT again to display Priority the first configuration option, Normal "Priority." Press ENT on it and use arrow keys to select an option. Press ENT confirm the change on priority level. Priority Step 5. Use arrow keys to move one To High level down to another option, "Iteration Count". This option Iteration Count determines how many times Single Time the scan is performed on the Iteration Count logical drive. If set to to Continuous "Continuous," the scan will in the background run continuously until it stopped by user.



IMPORTANT!

If Media Scan continuously runs in the background, considerable system resources will be consumed.

Step 6. Press ENT on your option to confirm.

Execute Media Scanning

Step 7. Press ENT for two seconds to display the confirm message, then press ENT to start scanning the array.

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Media Scan Task Schedule

The last of the Media Scan functional items is the Task Scheduler tool.

Task Schedule List

Step 1. Press ENT on the entry screen to display the following options:



Tips:

Every functional sub-menu displays with two periods ".." as the last digits. To access each configuration screen, press ENT once to change the last digits into a question mark "?". By then you will be able to use the arrow keys to display more options.

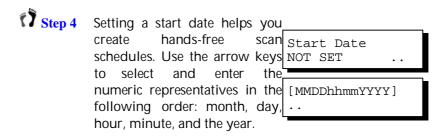
(7) Step 2. The first screen will demand vou to create a new Schedule. Press ENT for two seconds to confirm.

Add Media Scan Task Schedule

Executed on Controller Initialization

Step 3. Use your arrow keys and the Exec on Ctlr ENT key if you want the Init: NO Media Scan to be executed whenever the subsystem is rebooted.

Start Date





IMPORTANT!

Before a task schedule can take effect, make sure you configure appropriate time zone, date, and time for the onboard Real Time Clock.

Execution Period

Step 5. This option specifies the time Execution Period interval between two Scan Execution Once? instances in a series of repeated scans. The configurable values range from Execution Once, 1 second, to two weeks.

Execution Mode

§7 Step 6. This option allows an Execution Mode administrator select Concurrence concurrent or seguential operation mode if multiple task schedules co-exist on multiple RAID volumes. If Media Scan operates concurrently on multiple RAID volumes. 1/0 be responsiveness can affected.

Media Scan Priority

Step 7. This option allows you to priority specify the priority of a scheduled task among others.

The options are "Normal,"
"Improved," and "High."

Select Target

Step 8. This screen allows you to specify the target volumes that the scheduled scan will be performed on. Options are "All Logical Drives" or individual logical drive.

Once properly configured, the scheduled tasks will automatically run in accordance with your preferences.

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2.9.7 **Write Policy**

From the Main Menu, use the View and Edit up or down arrow keys to Logical Drives select "View and Edit Logical^L Drives".

(7) Step 2. The first logical drive LG0 RAID5 DRV=3 displays. If you have more 4095MB GD SB=0 than one logical drive, use the up or down keys to select the logical drive you want to change the write policy of; and then press ENT.

Use arrow keys to select "Write Policy" and then press ENT.

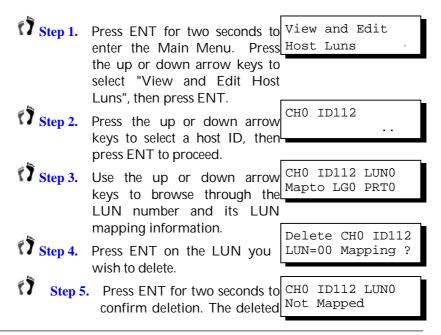
Write Policy

Write-Back cache setting İS configurable on a per array basis. Setting

Write Policy Write-Back

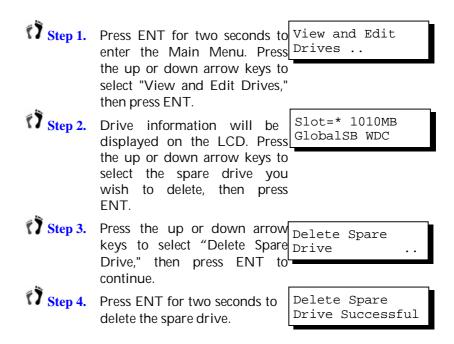
to the default value means the array setting is coordinated with the controller's general setting. The controller's general setting option can be found in "View and Edit Config Parms" -> "Caching Parameters" -> "Write-Back Cache". Note that cached writes are lost if a power failure occurs unless cached data has been duplicated to a partner controller and a battery is supporting cache memory.

2.10 **Viewing and Editing Host LUNs**



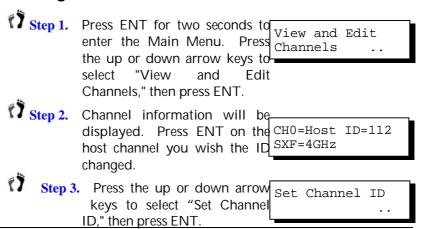
2.11 Viewing and Editing Drives

Deleting Spare Drive (Global / Local/Enclosure Spare Drive)



2.12 Viewing and Editing Channels

2.12.1 Viewing IDs



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Step 4. Use the up or down arrow, keys to browse through the CHL=0 ID=112 existing host IDs. Press ENT on any ID combination to continue.

2.12.2 Adding a Channel ID

Press ENT on a host channel, on "Set Channel ID", and then on an existing ID.

- Step 5-1-1. Use the up and down arrow Add Channel ID keys to select "Add Channel ID", then press ENT.
- Step 5-1-2. Use the up and down arrow keys to choose the ID you Add CHL=0 ID=113 wish to add, then press ENT for two seconds to complete the process.
- Step 5-1-3. A prompt will remind you Change Setting to reset the subsystem for Do Reset Ctlr the configuration change to take effect. You may press ENT to reset the subsystem immediately or you may press ESC to continue adding other host IDs and reset the subsystem later.

2.12.3 Deleting a Channel ID

- Step 5-2-1. Press ENT for two seconds View and Edit to enter the Main Menu. Channels Press the up or down arrow keys to select "View and CHL=Host ID=113 Edit Channels," then press SXF=AUTO ENT.
- Step 5-2-2. The first host channel should appear. Press ENT to sel e t a host channel.
- Step 5-2-3. Press ENT on "Set Channel ID "

Step 5-2-4. A list of host channel and host ID combinations will CHL=0 ID=112 appear. Use the up or down arrow keys to select an ID you wish to remove. Press ENT to select a channel ID combination.

Set Channel

Step 5-2-5. You will then be prompted by the "Add Channel ID"

option. Press the down arrow key to proceed.

Step 5-2-6. The "Delete Channel ID" Delete option will appear. Press ENT to display the confirm box. Press ENT for two seconds to remove the ID.

Delete Channel

Delete ID=113 ?

A prompt will remind you to reset the subsystem for the configuration change to tak effect. You may press ENT to reset the subsystem immediately or you may press ESC to continue adding other host IDs and reset the subsystem later.

Change Setting
Do Reset Ctlr ?



IMPORTANT!

- f Every time you make changes to channel IDs, you must reset the subsystem for the configuration to take effect.
- f For IDs reserved in different subsystem configurations, please refer to the Installation and Hardware Reference Manual that came with your subsystem. For subsystems featuring backend PCB connection, firmware can detect their b a rd types and
 - automatically apply the preset IDs. There is no need to set IDs for these models.
- f Multiple target IDs can be applied to host channels while every drive channel has only one or two IDs (two IDs in a dual-active controller configuration).

2.12.4 Data Rate

This option is available in the configuration menu of Fibre host channel and the drive channel configuration menus of Fibre-, SAS-, or SATA-based subsystems. Default is "AUTO" and should work fine with m o t disk drives. Changing this setting is not recommended unless some particular bus signal issues occur.

The host channel data rate setting allows a 4Gbit Fibre Channel to negotiate with devices communicating over 2 or 1GHz link if the link speed configuration is determined externally.

Most SAS/SATA-based systems connect only one drive per SAS/SATA channel (4 for multi-lane with SATA-II). This helps to avoid a single drive failure from affecting other drives. The

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maximum mechanical performance of today's drives can reach around 60MB/second (sustained read). This is still far below the bandwidth of a drive channel bus. Setting the SAS/SATA bus speed to a lower value can get around some problems, but will not become a bottleneck to system performance.

Note that the SAS/SATA speed is the maximum transfer rate of the SAS/SATA bus in that mode. It does not mean the drive can actually carry out that amount of sustained r d/write performance.

For the performance of each drive model, please refer to the documentation provided by drive manufacturers.

Host Channel:

Step 1. Select from Main Menu, "View and Edit Channels," and then a host channel you wish to change its data rate.

C0=Host PID=102 SID=NA SXF=AUTO

17 Step 2. Press ENT on the channel and use the arrow keys to find the "Data Rate" option.

Data Rate

Step 3. Press ENT on the Data Rate option to display "Set Chl=X Set Chl=X Data Data Rate To AUTO?", where "X" stands for the channel number.

Rate To AUTO ?

Step 4. Use your arrow keys to display a different data rate (1GHz or 2GHz). Press ENT to confirm a selection.

Drive Channel:

Step 1. Select from Main Menu. "View and Edit Channels," and then a drive channel you wish to change its data rate.

CHX=Drive PID=7 SID=8 SXF=AUTO

17 Step 2. Press ENT on the channel and use the arrow keys to find the "Data Rate" option.

View Chip Information

Step 3. Press ENT on the Data Rate option to display "Set ChI=X Data Rate To AUTO?", where "X" stands for the channel number.

Data Rate

Use your arrow keys to display a data rate value which ranges from 33 to

Set Chl=X Data Rate to AUTO ?

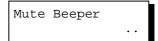
150MB/s (SATA drive channels). Press ENT to confirm a selection.

2.13 System Functions

Choose "System Functions" in the Main Menu, then press ENT. Press the up or down arrow keys to select a submenu, then press ENT.

2.13.1 Mute Beeper

When the controller's beeper has been activated, choose "Mute Beeper," then press ENT to turn the beeper off temporarily for the current event. The beeper will still ac t vate on the next event.



2.13.2 Password

Use he controller's password to prote t the system from unauthorized entry. Once the controller's password is set, regardless of whether the front panel, the RS-232C terminal interface or the RAIDWatch Manager is used, the user can only configure and monitor the RAID controller by providing the correct password.



IMPORTANT!

- f The controller requests a password whenever a user is entering the main menu from the initial screen or a configuration change is made. If the controller is going to be left unattended, the "Password Validation Timeout" should be set to "Always Check."
- f The controller password and controller name share a 32-character space. The maximum number of characters for a controller password is 32. If 31 characters are used for a controller name, there will be only one character left for the controller password and vice versa. Since revision 3.42J09, later firmware revisions support a 32-character space.

2.13.2.1 Change Password

Step 1. To set or change the controller password, press

Change Password ...

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the up or down arrow keys to select "Change Password," then press

ENT

If the password has previously been set, the controller will ask for the old password first. If password has not yet been set, the controller will directly ask for the new password. The password cannot be replaced unless the correct old password is provided.

Old Password

Re-Ent keys to select a character, then press ENT to move to the next space.

..

Change Password Successful

Password

Step 3. After entering all the characters (alphabetic or numeric), press ENT for two seconds to confirm. If the password is correct, or there is no preset password, it will ask for the new password. Enter the password again to confirm.

2.13.2.2 Disable Password

To disable or delete the password, press ENT on the first flashing digit for two seconds when requested to enter a new password. The existing password will be deleted. No pass rd checking will occur w

when entering the Ma h Menu from the initial terminal screen or making configuration changes.

2.13.3 Reset Controller

Step 1. To reset the controller without powering off the system, press the up or down arrow & ys to "Reset Controlle r" then press ENT.

Reset This Controller ?

Step 2. Press ENT again for two seconds to confirm. The controller will now reset.

2.13.4 Shutdown Controller

Before powering off the controller, unwritten data may still reside in cache

Shutdown This Controller ?

Shutdown This Controller ...

memory. Use the "Shutdown Controller" function to flush the cache content.

Step 1. Press the up or down arrow keys to "Shutdown Controller," then press ENT. Press ENT again for two seconds to confirm.

The controller will now flush the cache memory. Press ENT for two seconds to confirm and to reset or power off the subsystem.

ShutdownComplete Reset Ctlr?

2.13.5 Controller Maintenance

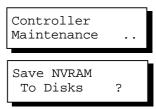
For Controller Maintenance functions, please refer to Appendix C.

2.13.6 Saving NVRAM to Disks

You can choose to backup your controller-dependent configurati **n** information to disks. We strongly recommend using this function to save the configuration profile whenever a configuration change is made. The information will be distributed to every logical drive in the RAID system. If using the RAIDWatch manager, you can save your configuration details as a file to a computer system drive.

A RAID configuration of drives must exist for the controller to write NVRAM content onto it.

Step 1. From the Main Menu, choose "System Functions."
Use arrow keys to scroll down and select "Controller Maintenance," "Save NVRAM to Disks," then press ENT.



Step 2. Press ENT for two seconds on the message prompt, "Save NVRAM to Disks?".

Restore with Password ?

A prompt will inform you that NVRAM in firmation has been successfully saved.

2.13.7 Restore NVRAM from Disks



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The Restore NVRAM is a function that carries some risks. Firmware restoration will not destroy the existing logical drive configurations; however, if the existing logical drives cannot be adequately associated with restoration, host might not be host ID/LUNs after your configured arrays.

If you want to restore your NVRAM information that was previously saved onto the array, use this function to restore the configuration setting.

Step 1. From the Main Menu, choose Restore NVRAM "System Functions." arrow keys to scroll down and select "Controller Maintenance." "Restore NVRAM from Disks..," and then press ENT.

Step 2. Press ENT for two seconds to confirm.

In case your previous password (reserved at the time you saved your NVRAM configurat on contents) different from your current password, you are provided with the options whether to restore the password you previously saved with your configuration profile.

Restore without Password

from Disks

A prompt will inform you that the controller NVRAM data has successfully restored from disks.

Adjust LCD Contrast

2.13.8

The controller LCD contrast is & t at the f a tory to a level that should be generally acceptable. The cont

m Iler is equipped wit an LCD contrast adjustment circuit in case the factory-preset level needs to be adjusted either via the RS-232 terminal emulation menus or using the LCD keypad panel.

View and Edit Peripheral Dev..

From the main menu, choose "View and Edit Peripheral Dev."

Adiust LCD Contrast

Step 2. Press ENT on it, press arrow keys to scroll down, and select "Adjust LCD Contrast," press ENT to proceed, and then use the arrow keys to find an optimal setting.

LCD Contrast :

Step 3. Press ESC to return to the previous menu.

Controller Parameters 2.14

2.14.1 Controller Name

Step 1. Select "View and Edit Config Parms" from the Main Menu.

Controller Name:

T Step 2. Choose "View and Edit Configuration Parameters," "Controller Parameters," then press ENT.

Enter Ctlr Name:

T Step 3. The current name will be displayed. Press ENT for two seconds and enter the new controller name by using the up or down arrow kevs. Press ENT to move to another character and then press ENT for two seconds on the last digit of the controller name to complete the process.

2.14.2 LCD Title Display Controller Name

Step 1. Choose "View and Edit Configuration Parameters," "Controller Parameters," then press ENT.

LCD Title Disp -Controller Logo?

Step 2. Use the up or down arrow Controller Name? keys to choose to display the embedded controller logo or any given name on the LCD initial screen.

LCD Title Disp -

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2.14.3 Password Validation Timeout

Step 1. Choose "View and Edit Configuration Parameters," "Controller Parameters," then press ENT.

PasswdValidation Timeout-5 mins..

Step 2. Select "Password Validation Timeout," and press ENT. Press the up or down arrow keys to choose to enable a validation timeout from one to five minutes, or to "Always Check."

The Always Check timeout will invalidate any configuration change without entering the correct password.

2.14.4 Controller Unique Identifier

Step 1. Choose "View and Edit Configuration Parameters," "Controller Parameters," then press ENT.

Ctlr Unique (Hex)-

- Step 2. Press the up or down arrow keys to select "Ctlr Unique ID-," then press ENT.
- Step 3. Enter any hex number between "0" and "FFFFF" and press ENT to proceed.

Enter a unique ID for any RAID controller in a single or dualcontroller configuration. The unique ID is recognized by the controller for the following purposes:

- The unique ID is combined to generate a unique WWN node name for controllers or RAID systems using Fibre Channel host ports. The unique node name helps prevent host computers from mis-addressing the storage system during a controller failback/failover process.
- MAC addresses for the controller's Ethernet port that should be taken over by a surviving controller in the event of controller failure.

2.14.5 Controller Date and Time

This submenu is only available for controllers or subsystems that come with a real-time clock onboard.

Time Zone

Choose "View and Edit Configuration Parameters," "Controller Parameters," then press ENT.

View and Edit Config Parms

Controller Parameters

Set Controller Date and Time ..

Press the up or down arrow keys to scroll down and select "Set Controller Date and Time", then press ENT.

The controller uses GMT (Greenwich Mean Time), a 24-hours clock. To change the clock to your local time zone, enter the hours later than the Greenwich mean time after a plus (+) sign. For example, enter "+9" for Japanese time zone.

Step 3. Choose "Time Zone" by pressing ENT.

Time Zone

Use the down key to enter the plus sign and the up key to enter numeric representatives.

GMT +08:00 GMT -

Date and Time

Step 5. Use your arrow keys to scroll down and select "Date and Time" by pressing ENT.

Date and Time

[MMDDhhmm[YYYY]]

Step 6. Use the arrow keys to select and enter the numeric representatives in the following order: month, day, hour, minute, and the year.

2.15 Drive Utilities

From the "View and Edit Drives" menu, s è ect the drive that the utility is to

Slot=* 1010MB NEW DRV SEAGATE

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be performed on; then press ENT.

Step 2.

Select "Drive Utilities; then press ENT. Choose "Read/Write Test".

View and Edit Drives

Drive Utilities

These options are not available for drives already configured in logical configurati **a**, and can only performed before a reserved space is created on a disk drive.

Drive Read/Write Test

2.15.1 Drive Read/Write Test

From the "View and Edit Drives" menu, select a new or used drive that the utility is to be performed on; then Select "Drive Utili ies;"t press ENT. then press ENT.

Drive Read/Write Test



(7) Step 3.

Choose "Read/Write Test" and press ENT.



Tips:

This function will not be available with a formatted, used drive. You may manually remove the 256MB reserved space to re-configure a used drive into a new drive.

Step 4. Press the up or down arrow keys to select and choose to enable/disable the following options:

Abort When Error Occur-Enabled ...

1. Read-Write Test Type - Read Only/Read and Write.

Drive Test for Read and Write..

- 2. Action on Detection of Error
- Continue Test
- Abort on Detection of Any Errors (including hardware, media errors, etc.)
- Abort on Detection of Hard Errors only (only hardware errors in SATA 8-bit encoding)
- 3. Recovery Process
- No Recovery
- Mark Blk Bad (mark the affected blocks as bad)
 - Reassignment (try to reassign data residing on the affected sect o s)
- Frst Try Reassi (Recovery by attempting to reassign and mark bad if reassignment fails)
- 4. Execute Drive Testing
- Step 5. When finished with configuration, select "Execute Drive Testing" and press ENT to proceed.
- Step 6. The Read/Write test progress will be indicated as a percentage.
- Step 7. You may press ESC and select "Read/Write Test" later and press the up or down arrow keys to select to "View Read/Write Testing Progress" or to "List Current Bad Block Table." If you want to stop testing the drive, select "Abort Drive"

RW Test Type .. Read Only ..

Action When Err: Continue Test ..

Recovery Process No Recovery ..

Execute Drive Testing

View Read/Write Test Progress ..

Drv Testing 23% Please Wait!

List Current Bad Block Table.

Abort Read/Write Testing ..

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Testing" and press ENT to proceed.

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3

Terminal Screen Messages

3.1 The Initial Screen

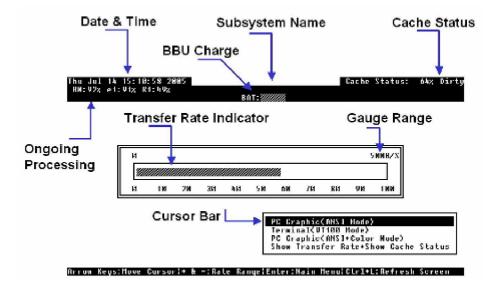


Figure 3-1: The RC-232C Terminal Initial Screen

Cursor Bar: Move the cursor bar to a desired item, then

press [ENTER] to select

Subsystem Name: Identifies the type of controller/subsystem or

a preset name

Transfer Rate Indicator: Indicates the current data transfer rate

Gauge Range: Use + (Shift+"+") or - keys to change the

gauge range in order to view the transfer rate

indicator

Cache Status: Indicates current cache status

Write Policy: Indicates current write-caching policy

Date & Time: Current system date and time, generated by

controller real-time clock

PC Graphic (ANSI Mode): Enters the Main Menu and operates in ANSI

mode

Terminal (VT-100 Mode): Enters the Main Menu and operates in VT-100

mode

PC Graphic (ANSI+Color

Mode):

Enters the Main Menu and operates in ANSI

color mode

Show Transfer Rate+Show

Cache Status:

Press [ENTER] on this item to show the cache

status and transfer rate

Ongoing Processing: e#: logical drive # is being expanded

i#: logical drive # is being initialized
R#: logical drive # is being rebuilt

P#: logical drive # Parity Regeneration

completion ratio

S#: logical drive # Media Scan completion

ratio

For more details, please refer to Section 6.4

Logical Drive Status

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3.2 Main Menu

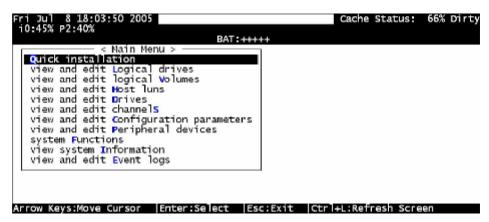


Figure 3-2: The Terminal Utility Main Menu

Use the arrow keys to move the cursor bar through the menu items, then press [ENTER] to choose a menu, or [ESC] to return to the previous menu/screen.

In a subsystem or controller head where battery status can be detected, battery status will be displayed at the top center. Status will be stated as Good, Bad, several "+ " (plus) signs (VT-100 mode), or color blocks (ANSI mode) will be used to indicate battery charge. A battery fully-charged will be indicated by five plus signs or color blocks.

When initializing or scanning an array, the controller displays progress percentage on the upper left corner of the configuration screen. An "i" indicates array initialization. An "s" stands for scanning process. The number(s) next to them indicate the logical drive number (e.g., logical drive 0).

3.3 Quick Installation

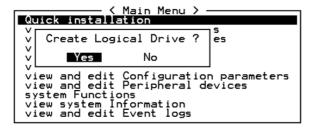


Figure 3-3: Quick Installation Page

Type Q or use the $\uparrow \downarrow$ keys to select "Quick installation", then press [ENTER]. Choose Yes to create a logical drive.

All possible RAID levels will be displayed. Use the $\uparrow \downarrow$ keys to select a RAID level, then press [ENTER]. The assigned spare drive will be a Local Spare Drive, not a Global Spare Drive.

All available disk drives in the enclosure will be included in one logical drive. The subsystem will start initialization and automatically map the logical drive to LUN 0 of the first host channel available.

3.4 Logical Drive Status

ri Oc	t 28 17:50	5 : 30	3 2005									Cache Status: Clean				
	BAT:+++++															
LG	ID	LU	RAID	Size(MB)	Status 1	2	3	0	С	#LN	#SB	#FL	NAME			
PO	78DFE33F	NA	KATD6	4000	GOOD			72	В	6	0	0				
S1	449FE016	NA	RAID6	4400	GOOD			7	В	6	0	0				
PZ	64745A71	NA	RAID6	5600	GOOD			7	В	6	0	0				
S3	2723A913	NA	RAID6	6400	GOOD			7	В	6	0	0				
4			NONE													
5			NONE													
6			NONE													
7			NONE			Г	Г	Г								

Arrow Keys: Move Cursor | Enter: Select | Esc: Exit | Ctrl+L: Refresh Screen | Figure 3-4: Logical Drive Status Screen



NOTE:

A logical drive in a single-controller subsystem is always managed by one controller, and the "P" or "S" indicator will not appear.

LG Logical Drive number

P PrimaryS Secondary

LV The Logical volume to which this logical drive belongs

ID Controller-generated unique ID

RAID RAID level

SIZE (MB) Capacity of the Logical Drive
Status 1 Logical Drive Status – Column 1

GOOD The logical drive is in good condition
DRV FAILED A drive member failed in the logical drive

CREATING Logical drive is being initiated

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DRV ABSENT An empty drive tray

INCOMPLETE Two or more drives failed in the logical drive

INVALID The logical drive was created but has not been

fully initialized when another version of firmware is being loaded. After the subsystem resets, the

array status should return to normal.

FATAL FAIL Two member drives failed at the same time, the

array is inaccessible

DRV MISS A member drive is missing; could result from

insecure installation

REBUILDING The logical drive is being rebuilt

Status 2 Logical Drive Status – Column 2

I Initializing drives

A Adding drive(s)

E Expanding logical drive

H Add drive operation on hold

Status 3 Logical Drive Status – Column 3

R Rebuilding the logical drive

P Regenerating array parity

Column O Logical Drive Status – Stripe size

N/A Default

2 4KB 6 64KB 3 8KB 7 128KB 4 16KB 8 256KB

A 1024KB

5

Column C Logical Drive Status – Write Policy setting

B Write-back

T Write-through

32KB

#LN Total drive members in the logical drive

#SB Standby drives available for the logical drive. This

9

includes all the spare drives (local spare, global spare)

512KB

available for the specific logical drive

#FL Number of Failed member(s) in the logical drive

Name Logical drive name (user configurable)

3.5 Logical Volume Status

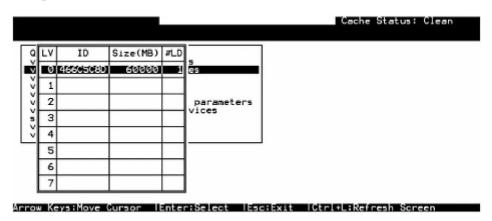


Figure 3-5: Logical Volume Status Screen



A logical volume in a single-controller subsystem is always managed by one controller, and the "P" or "S" indicator will not appear.

LV Logical Volume number.

ID Logical Volume ID number (controller randomly generated)

Size(MB) Capacity of the Logical Volume

#LD The number of Logical Drive(s) included in this Logical Volume

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3.6 Drive Status

					BAC	r:BaD		
JBOD	Slot	Chl	ID	Size(MB)	Speed	LG_DRU	Status	Vendor and Product ID
	9	5	3	35003	300MB	Θ	ON-LINE	SEAGATE ST336754SS
	10	5	2	35003	300MB	9	ON-LINE	SEAGATE ST336754SS
	11	5	1	35003	300MB	0	ON-LINE	SEAGNTE ST336754SS
	12	5	0	70007	300MB	0	ON-LINE	SEAGATE ST373454SS
9	1	3(4)	0	35003	300MB	0	ON-LINE	SEAGATE ST336754SS
9	Z	3(4)	1	35003	300MB	Θ	ON-LINE	SEAGATE ST336754SS
9	3	3(4)	2	35003	300MB	9	ON-LINE	SENGNIE ST306754SS
9	4	3(4)	3	35003	300MB	0	ON-LINE	SEAGATE ST336754SS

firrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl:L:Refresh Screen

Figure 3-6: Drive Status Screen

JBOD	JBOD ID of	the disk drive							
Slot	Slot number	of the disk drive							
Size (MB)	Drive capacity								
Speed	XXMB Max	imum transfer rate of the drive channel interface							
LG_DRV	Χ	The disk drive is a member of logical drive "X."							
		If the Status column shows "STAND-BY", the drive is a Local Spare belonging to logical drive "X."							
Status	Global	The disk drive is a Global Spare Drive							
	INITING	Proceeding with array initialization							
	ON-LINE	The drive is in good condition							
	REBUILD	Proceeding with array Rebuild process							
	STAND- BY	Local Spare Drive or Global Spare Drive. The Local Spare Drive's LG_DRV column will show the logical drive number. The Global Spare Drive's LG_DRV column will show "Global".							
	NEW DRV	A new drive has not been included in any logical drive or configured as a spare drive							
	USED DRV	An used drive that is not a member of any logical drive or configured as a spare							
	FRMT DRV	Formatted drive (drive formatted with a reserved section)							
	BAD	Failed drive							
	ABSENT	Drive does not exist							

MISSING Drive once existed, but is missing now

SB-MISS Spare drive missing

Vendor and The vendor and product model information of the drive

Product ID

3.7 Channel's Status

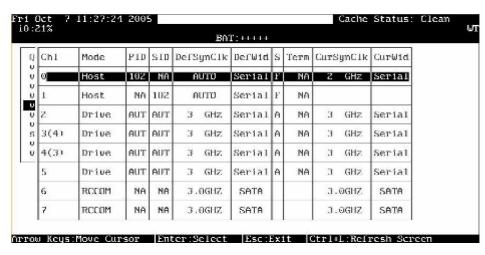


Figure 3-7: Channel Status Screen

Chl Channel number Mode Channel mode **RCCom** Redundant controller communication channel Host Host Channel mode Drive Drive Channel mode PID IDs managed by the Primary Controller Multiple IDs were applied (Host Channel mode only) (ID Host Channel: number) Specific IDs managed by the Primary Controller for host LUN mapping **Drive Channel:** Specific ID reserved for the channel processor on the **Primary Controller**

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SID IDs managed by the Secondary Controller

Multiple IDs were applied (Host Channel mode only)

(ID Host Channel:

number) Specific IDs managed by the Secondary Controller for

host LUN mapping

Drive Channel:

Specific ID reserved for the channel processor on the Secondary controller; used in redundant controller mode

No channel ID applied

AUTO Channel bus data rate set to auto speed negotiation

DefSynClk Default bus synchronous clock:

??.?M The default setting of the channel is ??.? MHz in

Synchronous mode.

Async. The default setting of the channel is Asynchronous mode.

DefWid Default bus width:

NA

Serial Serial transfer protocol; Fibre Channel, SAS Channel

S Signal:

F Fibre

A SAS

Term Terminator Status:

On Terminator is enabled.
Off Terminator is disabled.

Diff The channel is a Differential channel. The terminator can

only be installed/removed physically.

N/A Non-SCSI bus

CurSynClk Current bus synchronous clock:

??.?GHz The default setting of the channel bus is ??.? GHz

Async. The default setting of the channel bus is Asynchronous

mode.

(empty) The default bus synchronous clock has changed. Reset

the controller for the changes to take effect.

CurWid Current Bus Width:

Serial Serial transfer protocol; Fibre Channel, SAS Channel,

SATA Channel.

3.8 Controller Voltage and Temperature

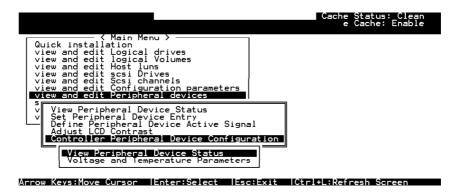


Figure 3-8: Controller Voltage and Temperature Monitoring Page

Choose from Main Menu "View and Edit Peripheral Devices," and press [ENTER]. From the submenu, choose "Controller Peripheral Device Configuration," "View Peripheral Device Status", then press [ENTER].

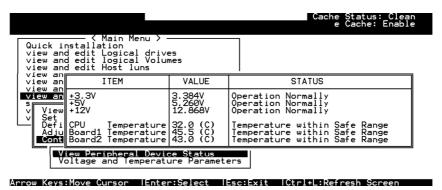


Figure 3-9: Controller Voltage and Temperature Status Screen

The current status of voltage and temperature detected by the controller will be displayed on-screen and will be stated as normal, out of order, within or within the safety range.

3.9 Viewing Event Logs on the Screen

When errors occur, you may want to trace the records to see what has happened to your system. The controller's event log management records all events starting from the time when the system is powered on, recording up to 1,000 events. Powering off or resetting the controller will cause an automatic deletion of all the recorded event logs. To view the events log on-screen, from the Main Menu "View and Edit Event Logs" by pressing [ENTER].

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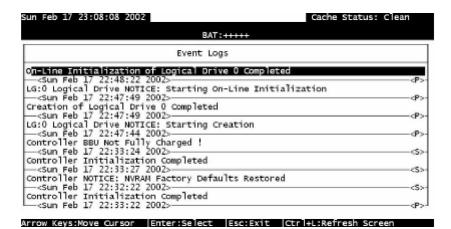


Figure 3-10: Event Logs Screen

To clear the saved event logs, scroll the cursor down to select an event and press [ENTER] to delete the event and the events below.



Figure 3-11: Clear Event Logs Dialogue Box

Choose Yes to clear the recorded event logs.

This page is intentionally left blank.

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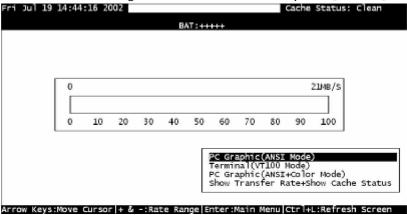
4

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4.1 Power on RAID Enclosure

Hardware installation should be completed before powering on your RAID enclosure. The subsystem and disk drives must be properly configured and initialized before the host computer can access the storage capacity. The configuration and administration utility resides in the controller's firmware.

Open the initial terminal screen: use the arrow keys to move the cursor bar through the menu items, then press [ENTER] to





All figures in this chapter are showing examples using the management hyper terminal screen.

4.2 Caching Parameters

4.2.1 Optimization Modes

Mass storage applications can be roughly divided into two categories—database and video/imaging—according to their read/write characteristics. To optimize system operation, there are two embedded optimization modes with system behaviors pre-adjusted to different read/write parameters: "Optimization

for Random I/O" and the "Optimization for Sequential I/O."

Limitations:

The following are the limitations on the use of optimization modes.

- 1. The system default is "Optimization for Sequential I/O."
- 2. You can select the stripe size of each array (logical drive) during the initial configuration. However, changing stripe size is only recommended for experienced engineers who have tested the effects of tuning stripe sizes for different applications.
- 3. The array stripe size can only be changed during the initial configuration process.
- 4. Carefully consider the outcome before choosing an optimization mode. Once the controller optimization mo de is applied, access to different arrays in a RAID system will follow the same optimized pattern. You can only change the optimization mode after deleting and re-creating the arrays.

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Database and Transaction-based Applications

These kinds of applications usually include SQL server, Oracle server, Informix, or other database services that keep the size of each transaction down to a minimum, so that I/Os can be rapidly processed. Due to their transaction-based nature, these applic ations do not read or write a bunch of data in a sequential order—access to data occurs randomly. The transaction size usually ranges from

2K to 4K. Transaction performance is measured in "I/Os per second" or "IOPS."

Video Recording/Playback and Imaging Applications

These kinds of applications usually include video playback, video post-production editing, or applications of a similar nature that tend to read or write large files to and from storage in a sequential order. The size of each I/O can be 128K, 256K, 512K, or up to 1MB. The efficiency of these applications is measured in MB per second (MBps).

When an array works with applications such as video or imageoriented applications, the application reads/writes from the drive as I arge-block, sequential threads instead of small and randomly accessed files.

The controller optimization modes have read-ahead buffer and other Read/Write characteristics tuned to obtain the best performance for these two major application categories.

4.2.2 Optimization Mode and Stripe Size

Each controller optimization mode has preset values for the stripe size of arrays created in different RAID levels. If you want a different optimization mode for a configured array, you must backup or move the stored data and recreate the arrays following the steps below:

- Stop host I/O access.
- 2. Move or backup all of your stored data in the subsystem.
- 3. Change the optimization mode.
- Reset the subsystem.

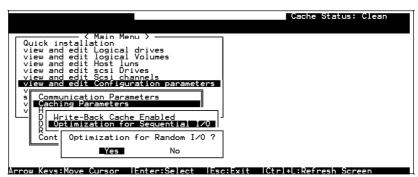
5. Re-create the array(s). Once the array(s) are created, stripe size cannot be changed.

Listed below are the default stripe sizes implemented with different o ptimization modes and RAID levels. These values should be sufficient for most applications.

	Stripe Size:	Stripe Size:				
	Opt. for Sequential I/O	Opt. for Random I/O				
RAID0	128KB	32KB				
RAID1	128KB	32KB				
RAID3	16KB	4KB				
RAID5	128KB	32KB				
RAID6	128KB	32KB				
NRAID	128KB	32KB				

Table 4-1: RAID Levels, Optimization Modes, and Stripe Sizes

4.2.3 Optimization for Random or Sequential I/Os



Choose "Optimization for Random I/O" or "Optimization for Sequential I/O," then press [ENTER]. The "Random" or

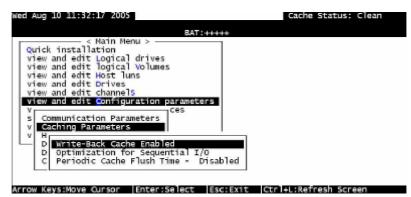
"Sequential" dialog box will appear, depending on the option you have selected. Choose Yes in the dialog box that follows to confirm the setting. Press [ESC] to exit and the setting will take effect after the subsystem is restarted.

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There is no longer a 512GB threshold for array optimization modes. If an array is larger than 16TB, only the optimization mode for sequential I/Os can be applied. Since logical drives of this size may not be practical, there is actually no limitation on the optimization mode and array capacity.

4.2.4 Write-Back Cache Enable/Disable



As one of the submenus in "Caching Parameters," this option controls the cached write policy.

Choose Caching Parameters, then press [ENTER]. Select Write-Back Cache, then press [ENTER]. "Enabled" or "Disabled" will display the current setting with Write-back caching. Choose Yes in the dialog box that follows to confirm the setting.

The Write-through mode is safer if your controller is not configured in a redundant pair and there is no battery backup or UPS device to protect cached data.

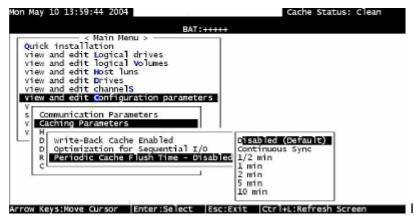
Write-back caching can dramatically improve write performance by caching the unfinished writes in memory and letting them be committed to drives in a more efficient manner. In the event of power failure, a battery backup module can hold cached data for days.

The Default option should be considered as "Not-Specified." If set to Default, the logical drive's caching behavior will be automatically controlled by firmware. In the event of component

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failure or violated temperature threshold, Write-back caching will be disabled and changed to a conservative "Write-through" mode.

4.2.5 Periodic Cache Flush



f Write-back caching is preferred for better performance yet data integrity is also a concern, e.g., no battery protection, the system can be configured to flush the cached writes at preset intervals.

Note that the "Continuous Sync" option holds data in cache for as long as necessary to complete a write operation and immediately commits a write request to hard drives if it does not come in a series of sequential write requests.



IMPORTANT!

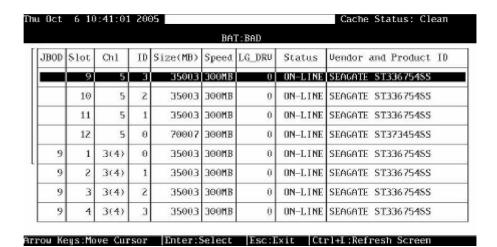
- f If the size of an array is larger than 16TB, only the optimization for sequential I/O can be applied. Since a logical drive of this size may not be practical, there is actually no limitation on the combination of optimization mode and array capacity.
- f Every time you change the Caching Parameters you must reset the controller for the changes to take effect.

The Adaptive Write Policy is applicable to subsystems working u nder normal conditions. If, for example, a drive fails in an array, the firmware automatically restores the array's original write policy.

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4.3 Viewing the Connected Drives

Prior to configuring disk drives into a logical drive, it is necessary to understand the status of the physical drives in your enclosure.



Use the arrow keys to scroll down to "View and Edit Drives" to display information on all the physical drives installed.

Drives are listed in the "View and Edit Drives" table. Use the arrow k eys to scroll the table. First examine whether there is any drive installed but not listed here. If a disk drive is installed but not listed, the drive may be defective or not installed correctly. If so, please contact your RAID supplier.



The JBOD column will show an ID set by the JBOD's DIP switches.

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IMPORTANT!

- f Drives of the same brand/model/capacity might not have the same block number. Setting the available drive space (that wi II be used from each member drive) to a lower number during the logical drive configuration process may help to get around this issue.
- f The basic read/write unit of a hard drive is block. If members of a logical drive have different block numbers (capacity), the smallest block number will be taken as the maximum capacity to be used in every drive. Therefore, use drives of the same capacity.

You may assign a Spare Drive to a logical drive whose members have a block number equal or smaller than the Local/Global Spare Drive, but you should not do the reverse.

4.4 Creating a Logical Drive

17	Step 1.	E	3row:	se tl	hrou	ıgh the N	⁄la	in	Ν	1e	nu	anc	l se	lect " <i>View and</i>	
Thu Ju	Thu Jul 21 17:18:22 2005 Cache Status: Clean BAT:++++														
LG	ID	LV	RAID	size	(MB)	Status	1 2	3	0	c	⊭LN	#5B	#FL	NAME	
0			NONE												
Q	reate Logi		İ												
	Yes		No					l							
3			NONE				I								
4			NONE												
5			NONE												
6			NONE					I							
7			NONE					L							

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

Step 2.

For the first logical drive on the RAID subsystem, simply choose the first logical drive entry, *LG 0*, and press [ENTER] to proceed. You may create as many

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as 16 logical drives or more using drives in a RAID subsystem or in a cascaded enclosure.



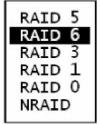
When prompted to "Create Logical Drive?," select Yes and press [ENTER] to proceed.

Create Logical Drive ?
Yes No

4.4.1 Choosing a RAID Level



A pull-down list of supported RAID levels will appear. Choose a RAID level for this logical drive. In this chapter, RAID 6 will be used to demonstrate the configuration process.



4.4.2 Choosing Member Drives



Step 5.

Choose your member drive(s) from the list of available physical drives. Tag the drives for inclusion by positioning the cursor bar on the drive and then pressing [ENTER]. An asterisk "*" will appear in front of the selected physical drive(s). To deselect the drive, press [ENTER] again on the selected drive and the asterisk "*" will

disappear. Use the same method to select more member drives.

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Sep	27 15	5:54:36	300	55				Cache	Status	: Cl	вап
					BA*				4 of	24	Selecte
JBOD	Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor	and Pro	duct	ID
		2	3	35003	300MB	NONE	NEW DRU		ST3361	5455	
•	2	2	2	35003	BEOME	NONE	NEW ORU	SERBATI	ST3361	5455	
•	3	2		35003	BUOMB	NONE	NEW DRU		ST336	5455	
	4	2	8	35003	SØØMB	NONE	NEW DRU		ST3361	54S5	
	5	5	7	35003	300MB	NONE	NEW ORU	SEAGATE	ST3367	75455	
	6	5	6	35003	300MB	NONE	NEW DRU	SEAGATE	ST3367	754SS	
	7	5	5	35003	300MB	NONE	NEW ORU	SEAGATE	ST3367	75455	
	8	5	4	35003	300MB	NONE	NEW DRU	SEAGATE	ST3367	754SS	
		JB00 Slot	JB00 Slot Chl - 1 2 - 2 3 - 3 - 2 - 5 5 - 6 5 - 7 5	JBOD Slot Chi ID		### ### ##############################	BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT: BAT:	BAT:	### 1 10 Size(MB) Speed LG_DRV Status Vendor	# of JBOD Slot Chl ID Size(MB) Speed LG_DRV Status Vendor and Pro	### DRT: STATE 10 Size(MB) Speed LG_DRV Status Vendor and Product

Arrow Keys:Move Cursor |Enter:Select |Esc:Confirm |Ctrl+L:Refresh Screen

4.4.3 Logical Drive Preferences

```
Maximum Drive Capacity: 9999MB
Assign Spare Drives
Disk Reserved Space: 256 MB
Logical Drive Assignments
Write Policy: Default(Write-Back)
Initialize Mode: On-Line
Stripe Size: Default
```

Step 6.

After all member drives have been selected, press [ESC] to continue with the next option. A list of array options is displayed.

4.4.3.1 Maximum Drive Capacity

Maximum Available Drive Capacity(MB): 239112 Maximum Drive Capacity(MB) : 239112

17

tep 6-1. As a rule, a logical drive should be composed of drives of the same capacity. A logical drive can only use the capacity of each drive up to the maximum capacity of the smallest member selected for the array.

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4.4.3.2 Assign Spare Drives

34747MB Maximum Drive Capacity : Assign Spare Drives Disk Reserved Space: 256 MB Write Policy: Default(Write-Back) Initialize Mode: On-Line Stripe Size: Default (128K Butes)

JBDD	Slot	Chl	10	Size(MB)	Speed	LG_ORV	Status	Vendor and Product 10
•	5	5	7	35003	elalalai:	NONE	NEW DRU	SERGATE 5T33675455
	Б	5	6	35003	300MB	NONE	NEW DRV	SERGRTE 5T33675455
	7	5	5	35003	300MB	NONE	NEW DRU	SERGATE 5T33675455
	В	5	4	35003	300MB	NONE	NEW DRU	SEAGATE ST33675455
	9	5	3	35003	300MB	NONE	NEW DRU	SEAGATE ST336754SS
	10	5	5	35003	300MB	NONE	NEW ORU	SEAGATE ST336754SS
	11	5	1	35003	300MB	NONE	NEW DRU	SEAGATE ST336754SS
	12	5	Ø	35003	300MB	NONE	NEW DRU	SEAGATE ST33675455



Step 6-2. You can add a spare drive from the list of the unused drives. The spare chosen here is a Local spare and will automatically replace any failed drive within the logical drive. The controller will then rebuild data onto the replacement drive in the ev ent of disk drive failure.

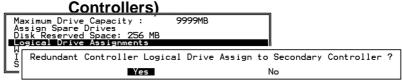
A logical drive composed in a non-redundancy RAID level (NRAID or RAID 0) does not support spare drive rebuild.

4.4.3.3 Disk Reserved Space

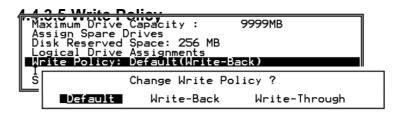


The reserved space is a small section of disk space formatted for storing array configuration and RAIDWatch program data. This item is for disp lay only—you cannot change the size of the reserved space.

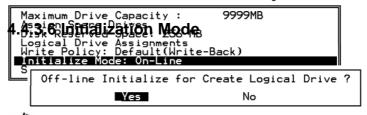
4.4.3.4 Logical Drive Assignments (Dual-Active



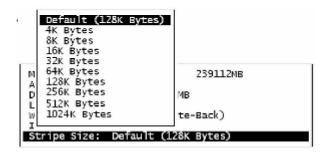
Step 6-4. If you use two controllers for a dual-active configuration, a logical drive can be assigned to either of the controllers to balance workload. The default is the Primary Controller; press [ESC] if change is not preferred.



Step 6-5. This sub-menu allows you to select the caching mode for this specific logical drive. "Default" is a neutral value that is coordinated with the subsystem's general caching mode setting shown in brackets in the Write Policy status.



Step 6-6. This sub-menu allows you to see if the logical drive is immediately available. If the online (default) mode is used, logical drive is immediately ready for I/Os and you may continue with array configuration, e.g., including the array int o a logical volume, before the array's initialization process is completed.





This option should only be changed by experien ced technicians. Setting to an incongruous value can severely drag performance, therefore, this option should only be changed when you can be sure of the performance gains it might bring you. For example, if your array is often stressed by larger and sequential I/Os, setting a small stripe size you may lose the efficiency brought by parallel executions.

The default value is determined by the combination of the controller Optimization Mode setting and the RAID level selected for the specific logical drive.

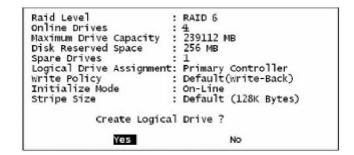
Press [ESC] to continue when all the preferences have been set.



NOTE:

The Stripe size here refers to the "Inner Stripe Size" specifying the chun k size allocated on each individual data disk for parallel access instead of the "Outer Stripe Size" that is the sum of chunks on all data drives.

Terminal Operation 4-13



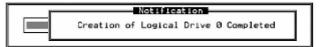
Step 7.

A confirm box will appear on the screen. Verify all information in the box before choosing *Yes* to confirm and proceed.

Notification LG:0 Logical Drive NOTICE: Starting Creation

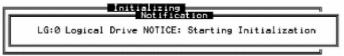
Step 8.

If the online initialization mode is applied, the logical drive will first be created and the controller will find an appropriate time to initialize the array.



(7

Step 9. The completion of array creation is indicated by the message prompt above.



Ϋ́

7 Step 10.

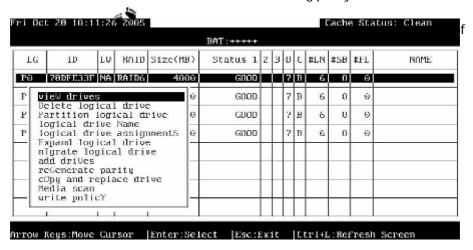
A controller event will then prompt to indicate that the logical drive initialization has begun. Press [ESC] to cancel the "Notification" prompt, and a progress indicator will display on the screen as a percentage bar.

Step 11. While the array initialization runs in the background, you can start using the array or continue configuring your RAID subsystem.

39% Completed

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When a fault-tolerant RAID level (RAID 1, 3, 5 or 6) is selected, the subsystem will start initializing parity.





IMPORTANT!

Only logical drives with RAID levels 1, 3, 5, or 6 will take the time to initialize the logical drive. Logical drives with RAID level 0 and NRAID do not perform logical drive initialization. With RAID0 or NRAID, the drive initialization process finishes almost immediately.

4.5 RAID Migration

Currently the RAID migration function supports the migration between RAID5 and RAID6.

Before proceeding with RAID migration, make sure you have sufficient free capacity or unused drives in your RAID array. RAID6 arrays require at least four (4) member drives and use additional capacity for the distribution of secondary parity. For example, if you want to migrate a RAID5 array consisting of three

(3) drives to RAID6, one additional disk drive must be available. The different features of RAID5 and RAID6 arrays are summarized as follows:

	RAID5	RAID6				
Min. No. of Member Drives	3	4				
Raw Capacity	N	N				
Usable Capacity	N-1 (1 drive's capa city used for storin g parity data)	N-2 (2 drives' cap acity used for stor ing parity data); N>=2				
	If individual disk capacity = 100G,					
	Capacity of a 4-drive	RAID5 =				
	(4 -1) x 100G = 300G	= 300G				
	Capacity of a 4-drive	e RAID6 =				
	(4 -2) x 100G = 200G					
Redundancy	Single disk drive failure	2 disk drives to fail at the same time				

4.5.1 Requirements for Migrating a RAID5 Array

The precondition for migrating a RAID5 array to RAID6 is:

The usable capacity of the RAID6 array should be equal or larger than the usable capacity of the original RAID5 array.

To obtain a larger capacity for migrating to RAID6, you can:

- 1). Add Drive(s): Include one or more disk drives into the array.
- 2). Copy and Replace: Use larger disk drives in the array to replace the original members of the RAID5 array.

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4.5.2 Migration Methods

The conditions for migrating a RAID5 array to RAID6 are diagrammed as follows:

Fault condition:

The usable capacity of the RAID6 array is smaller than the usable capacity of the original RAID5 array.

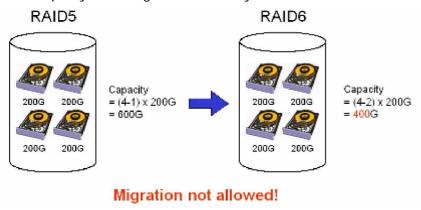


Figure 4-1: Migration Not Allowed for Insufficient Capacity

Migration by Adding Drive(s):

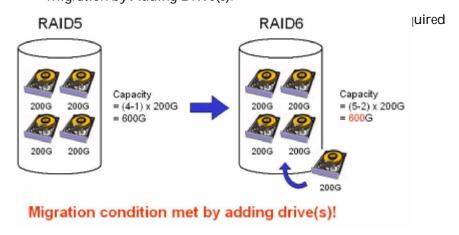


Figure 4-2: Migration Condition Met by Adding Drive(s)

Terminal Operation 4-17

Migration by Copy and Replace:

The additional capacity for composing a RAID6 array is acquired by using larger drives as the members of the array.

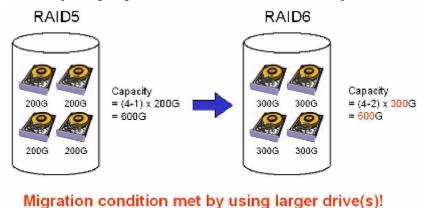
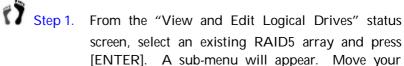


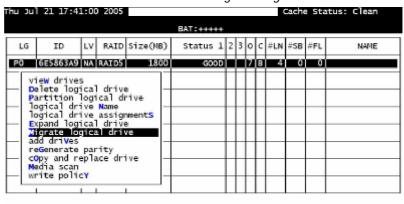
Figure 4-3: Migration Condition Met by Using Larger Drives

4.5.3 Migration: Exemplary Procedure

To migrate a RAID5 array to RAID6, follow the steps below:



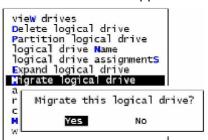
cursor bar to select Migrate Logical Drive.



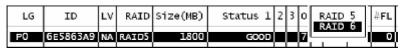
Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

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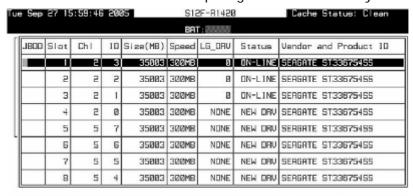
A confirm box should appear. Select Yes to proceed.



Step 3. selection box should prompt allowing you to choose a RAID level to migrate to. Press [ENTER] on RAID6.



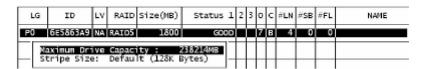
Step 4. A list of member drives and unused disk drives (new or used drives) should prompt. In the case of migrating a 3-drive RAID5 to 4-drive RAID6, you can select the original members of the RAID5 array and select one more disk drive to meet the mini mum requirements of RAID6. You may also select different disk drives in your RAID enclosure for composing the new RAID6 array.



Step 5. Press [ESC] to proceed to the next configuration screen. A sub-menu should prompt.

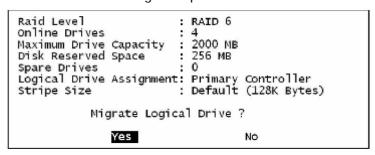
You may either change the maximum capacity to be included in the new RAID6 array or change the array stripe size.

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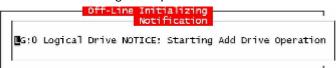


Step 7. A confirm box should prompt. Check the configuration details and select *Yes* to start the migration process.



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Step 8. A message should prompt indicating the migration process has started.



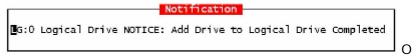
17

Step 9. Press [ESC] to clear the message. The initialization

off-Line Initializing
7% Completed



Since the migration process includes adding a new member drive, the completion of RAID migration is indicated as follows:

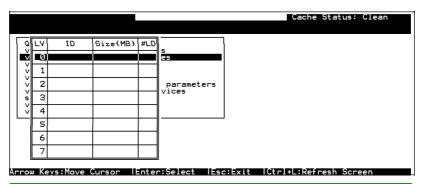


nce the migration is completed, associate the RAID6 array with the ID/LUN number originally associated with the previous RAI D5 array.

Please refer to Section 4.9 Mapping a Logical Volume to Host LUNs for more information.

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4.6 **Creating a Logical Volume**





TIPS:

A logical volume consists of one or several logical drives. These logical drives are striped together.

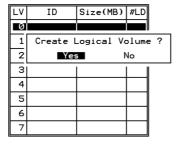
For example, A RAID50 volume is one that consists of several RAID5 arrays using the block-level striping method known as RAID0. A RAID50 logical volume is actually a RAID0 volume striped across RAID5 arrays.



1 Step 1.

Select "View and Edit Logical Volumes" in the Main Menu to display the current logical volume configuration and status on the screen.

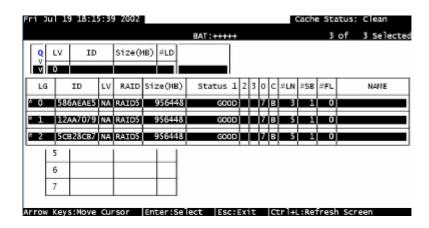
a logical volume number (0 to 7) that has not yet been defined, and then press [ENTER] to proceed.





A prompt "Create Logical Volume?" will appear. Select Yes and press [ENTER].

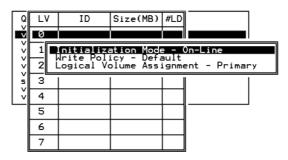
4-21 **Terminal Operation**



Step 3.

Select one or more logical drive(s) available on the list. The same as creating a logical drive, the logical drive(s) can be tagged for inclusion by positioning the cursor bar on the desired disk drive and pressing [ENTER] to select. An asterisk (*) will appear on the selected logical drive. Pressing

[ENTER] again will deselect a logical drive.

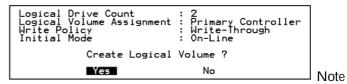


Step 4.

Use the arrow keys to select a sub-menu and change the initialization mode, write policy, or the managing controller.

Step 5.

Logical volumes can be assigned to different controllers (primary or secondary). The default is primary.

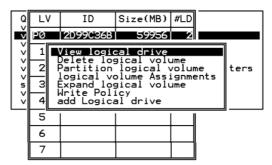


that if a logical volume is manually assigned to a specific controller, all its members' assignments will also be shifted to that controller.

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When all the member logical drives have been selected, press [ESC] to continue. The confirm box displays. Choose *Yes* to create the logical volum e.



Step 7.

Press [ENTER] on a configured volume, and the information of the created logical volume displays.

LV: Logical Volume ID

ID: Unique ID for the logical volume, randomly

generated by the RAID controller firmware

Size: Capacity of this volume

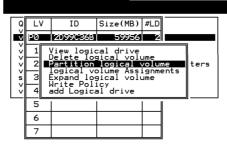
#LD: Number of the included members

4.7 Partitioning a Logical Drive/Logical Volume

The process of partitioning a logical drive is the same as that of partitioning a logical volume. The partitioning of a logical volume is used as an example in the proceeding discussion.

Note that partitioning can be very useful when dealing with a very la rge capacity; however, partitioning a logical drive or logical volume is not a requirement for RAID configuration.

Terminal Operation 4-23



Arrow Keys:Move Cursor | | Enter:Select | | Esc:Exit | | Ctrl+L:Refresh | Screen



Select the logical volume you wish to partition, then press [ENTER]. Choose *Partition logical volume*, then press [ENTER]. Select from the list of undefined partitions and press [ENTER].

Step 2. A partition list displays. If the logical volume has not yet been partitioned, all volume capacity will list as "partition 0."

Q	LV	ID	Size(MB)	#LD		Partition	Offset(MB)	Size(MB)	
V	PØ	2D99C36B	59956	2		0	Ø	59956	
ľ	1					D+:+:	Size (MB):	E00E/	
	2				arameter	Partition	312e (MB).	37736 _	
5	3				ces 🗀	3			
	4					4			
	5					5			
	6					6			
	7					7			

Step 3. Press [ENTER] and key in the desired capacity for the selected partition, and then press [ENTER] to proceed. The remaining capacity will be automatically allotted to the next partition.

Step 4. When prompted by the "Partition Logical Volume?" message, choose Yes to confirm then press [ENTER]. Follow the same procedure to partition the remaining

L a	LV	ID	Si EE(MB) (MLAD	of	you	r Paddical	Offich(MB)	Size(MB)				
V	PØ	2D99C36B	59956	2			0	0	59956				
\ \ \ \	1						This operation will result in the LOSS OF ALL DATA on the Partition !						
v	2				arame	eter	Partition Logical Volume ?						
5					ces		Ye						
`						L	"	25	No				
	5						5						
	6						6						
	7						7						

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When a partition of a logical drive/logical volume is deleted, the capacity of the deleted partition will be a dded to the previous partition.

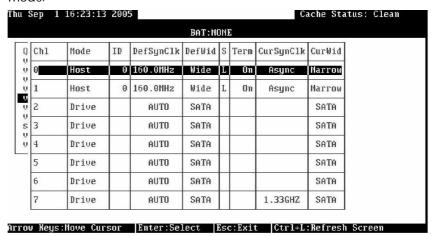


WARNING!

- f Whenever a partition is changed, it is necessary to reconfigure all host LUN mappings. All data in it will be lost and all host LUN mappings will be removed when there is any change to the partition capacity.
- f If operating in a Unix-based system, reset the subsystem for the configuration changes to take effect if any changes were made to partition sizes and partition arrangement.

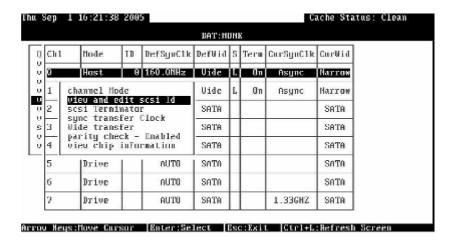
4.8 Viewing and Editing Channels

Falcon III / Magellan / X4 subsystems come with preset data paths and there is no need to modify channel configurations, e.g., channel mode.



Choose View and Edit Channels in the Main Menu to display channel status.

Terminal Operation 4-25

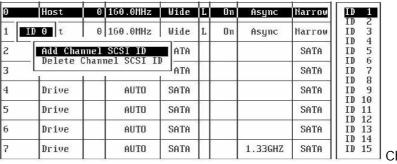




IMPORTANT!

Most Falcon III / Magellan / X4 subsystems have preset host, drive channels that cannot be changed. Therefore the channel mode option is not available.

4.8.1 Viewing and Editing IDs - Host Channel



oose a host channel, then press [ENTER]. Choose *View and Edit ID*. A list of existing ID(s) will be displayed on the screen. Select one of the existing IDs and press [ENTER]. You may then choose to a dd or delete an existing ID.

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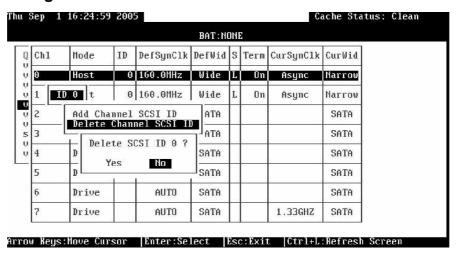
4.8.2 Adding an ID

0	Host	0 160.0MHz	Wide		On	Async	Narrow
	ID 0 t	0 160.0MHz	Wide	L	On	Async	Narrow
2		el SCSI ID	ATA		- 1		SATA
3	- Netere Cu	annel SCSI I	ATA		- 1		SATA
l	Drive	AUTO	SATA		10		SATA
5	Drive	AUTO	SATA	Sec. 1			SATA
6	Drive	AUTO	SATA		8		SATA
7	Drive	AUTO	SATA			1.33GHZ	SATA

Pres

s [ENTER] on one of the existing IDs. Choose *Add Channel ID*, and then choose to assign an ID. A list of host IDs will appear. Choose an ID. DO NOT choose an ID used by another device on the same channel.

4.8.3 Deleting an ID



Choose the host bus ID you wish to delete. Choose *Delete Channel ID*. The dialog box "Delete ID#?" will appear. Select *Yes*, then press [ENTER] to confirm.

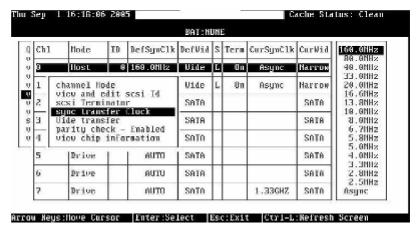


IMPORTANT!

- f Every time you change a channel ID, you must reset the subsystem/controller for the changes to take effect.
- f Multiple target IDs can be applied to a host channels while each drive channel has only one ID.
- f At least one controller's ID has to be present on each channel bus.

Terminal Operation 4-27

4.8.4 Data Rate (Channel Bus)



This option is available in the configuration menu of Fibre host channel and the drive channel configuration menus of Fibre-

or SATA-based subsystems. Default is "AUTO" and should work fin e with most disk drives. Changing this setting is not recommended unless some particular bus signal issues occur.

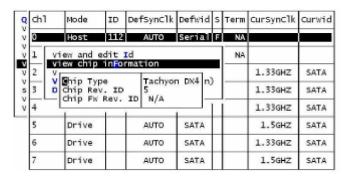
SATA/ATA-based Most systems connect only per SATA/ATA channel (4 for multi-lane with SATA II) to help avoid a single drive failure from affecting other drives. The maximum mechanical performance of todav's drives can reach around

40MBps (sustained read) which is still far below the bandwidth of a d rive channel bus. Setting the SATA bus speed to a lower value can get around some problems, but will not become a bottleneck to system performance.

Note that the SATA/ATA speed is the maximum transfer rate of the S ATA/ATA bus in that mode. It does not mean the drive can actually carry out that amount of sustained read/write performan ce. For the performance of each drive model, please refer to the documentation provided by drive manufacturer.

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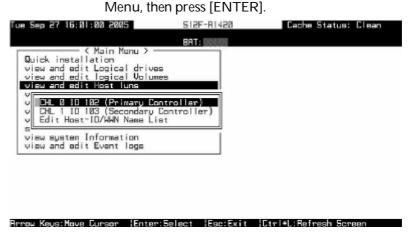
4.8.5 View Chip Information



This is a view only option showing basic information about the SCSI-320 Channel chip processor.

4.9 Mapping a Logical Volume to Host LUNs

Step 1. Select "View and Edit Host luns" in the Main



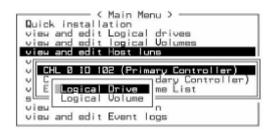
Step 2

A list of host channel/ID combinations appears on the screen. The diagram above shows two host channels and each is designated with a default ID. More can be added on each channel.

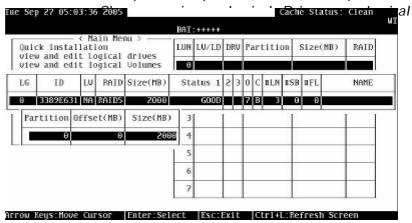
Step 3. Multiple IDs on host channels are necessary for redundant controller configuration. Details on creating multiple IDs and changing channel modes will be discussed later. Choose a host

ID by pressing [ENTER].

Terminal Operation 4-29



Step 4. Choose the channel-ID combination you wish to map, then press [ENTER] to proceed.



Step 5.

A list of LUN entries and their respective mappings will display. To map a host LUN to a logical volume's partition, select an available LUN entry

(one not mapped yet) by moving the cursor bar to the LUN, then press [ENTER].

- Step 6. A list of available logical volumes displays. Move the cursor bar to the desired logical unit, then press [ENTER].
 - Step 7. A list of available partitions will prompt. Move the cursor bar to the desired partition, then press [ENTER]. If you have not partitioned the logical volume, the whole capacity will be displayed as one logical partition.
- Step 8. When prompted to "Map Host LUN," press [ENTER] to proceed.

Map Host LUN

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When prompted to "Map Logical Volume?," select Yes to continue.



A prompt will display the mapping you wish to create. Choose Yes to confirm the LUN

-FYA	whyirh B	₽₽¥ı	Psetetted		Size(M	3)	RAID
	ji i i		I				
	Map	Logi	cal Volume	:	0		
	То	Chai	cal Volume tition nnel		Ø		
		Lun		:	Ø?		
	1	Yes	■ No	0			
	5			Ι			
-	5						
7	7						

The detail in the confirm box reads: partition 0 of logical volume 0 will map to LUN 0 of ID 0 on hos t channel 0.

Continue to map other partitions to host LUNs.



NOTE:

f

Once any host ID/LUN is successfully associated with a logical c apacity, the "No Host LUN" message in the LCD screen will c hange to "Ready."

f If you want to create more host IDs on your host channels, please proceed to Section 4.14

4.10 Assigning a Spare Drive and Rebuild Settings

4.10.1 Adding Local Spare Drive

A spare drive is a standby drive that automatically participates in the rebuild of logical arrays. A spare drive must have an equal or larger capacity than the array members. A Local Spare is one that participate in the rebuild of a logical drive it is assigned to. A Global Spare participates in the rebuild of all configured logical drives, and it should have a capacity equal to or larger than all physical drives in a RAID subsystem.

An Enclosure Spare only participates in the rebuild of a failed drive located within the same enclosure.



NOTF:

An Enclosure Spare is one that is used to rebuild a failed drive that resides in the same enclosure.

In configurations that span across multiple enclosures, a Global spare m ay participate in the rebuild of a failed drive that resides in a different en closure. Using Enclosure Spare can avoid disorderly locations of membe r disk drives if a previous rebuild involved a Global Spare that resides in



Choose "View and Edit Drives" Main Menu, then press [ENTER]. Move the cursor b ar to a drive that is not assigned to a logical drive or as a spare drive (usually indicated as a "New Drive"), and then press [ENTER].

LG	ID	LV	RAID	Size(M8)	Status 1	2	3	o	¢	∄LN	#58	#FL	NAME
PO	586AEAES	NA	RATD5	956448	GOOD			7	8	5	1	0	
P1	12AA7079	NA	RAIDS	956448	GOOD	Г	Г	7	В	5	1	0	
P2	5c828c87	NA	RAIDS	956448	GOOD	Г	Г	7	В	5	1	0	

Step 2. Choose "Add Local Spare Drive" and press [ENTER]. A list of logical drives displays.

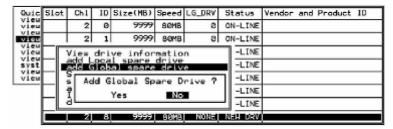
Move the cursor bar to a logical drive, then press [ENTER]. The unassigned disk drive will be associated with this logical drive as a Local Spare.

When prompted to "Add Local Spare Drive?," choose Yes to confirm.



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4.10.2 Adding a Global Spare Drive



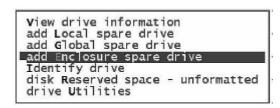
Step 1.

Move the cursor bar to the drive that is not a member drive or a spare (usually indicated as a "New Drive"), and then press [ENTER].

Step 2.

Select "Add Global Spare Drive." When prompted to "Add Global Spare Drive?," select Yes.

4.10.3 Adding an Enclosure Spare Drive





Move the cursor bar to a that is not a member dr ive or a spare (usually indicated as a "New Drive"), a nd then press [ENTER].

Step 2. Select "Add Enclosure Spare Drive."
When prompted to "Add Enclosure Spare Drive?,"
select Yes to complete the process.

4.11 Viewing and Editing Logical Drives and Drive Members

Choose "View and Edit Logical Drives" in the Main Menu to display the array status. Refer to the previous chapter for more details on the legends used in the Logical Drive's status. To see the drive member information, choose the logical drive by pressing

FENTER.

4-33

Wed :	Sep	7 14:03	3:16	5 2005							(Cache	sta	atus: Clean	
	BAT: NONE														
L	G	ID	LV	RAID	Size	(MB)	Status 1	2	Э	0	C	#LN	#SB	#FL	NAME
0		12E37A22	NA	6428	GOOD			7	В	4	0	0			
		eW drives				428	G00D			7	В	4	0	0	
	Pa	lete logi rtition l	log:	ical di		642	GOOD			7	В	4	0	0	
	Ex	gical dri pand logi													
	ad	grate log d dri∀es	Je												
	c0	Generate Ipy and re													
		dia scan ite polic													
7															

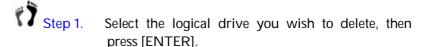
Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

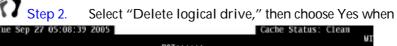
The disk drive-related functions include:

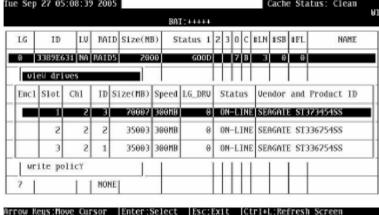
	Function	Description
1	View Drive	Displays member drive information
2	Delete Logical Drive	Deletes a logical drive
3	Partition Logical Drive	Create or remove a partition from a logical drive
4	Logical Drive Name	Assigns a name to a logical drive
5	Logical Drive Assignments	Assigns a logical drive to the Primary or Secondary RAID controller
6	Rebuild Logical Drive	Manually rebuilds a logical drive when a failed drive is replaced
7	Expand Logical Drive	Expands the unused capacity of a logical drive
8	Migrate Logical Drive	Migrates a logical drive to a different RAID level
9	Add Drives	Adds physical drive(s) to a logical drive
1	Regenerate Parity	Regenerates a logical drive's parity
1	Copy and Replace Drive	Copies or replaces members of a logical drive
1 2	Media Scan	Configures Media Scan priority, iteration count, and task schedules
1 3	Write Policy	Changes the write policy associated with the logical drive

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4.11.1 Deleting a Logical Drive







4.11.2 Deleting a Partition of a Logical Drive

Q	LG	ID	LV	RAID	Size(MB	Pa	rtition	Offset(MB)	Size(MB)	NAME
V	190	4149A729	NA	RAIDS	35		Ø	Ø	39 9 9	
V	P1	76CD4DF6	NΑ	RAIDØ	119			टाराहर	3999	
V	2			NONE			D1	ition Size ('MD). 0	
5	3			NONE			Parti	ition Size (.MB): 0	
	4			NONE			4	15999	3999	
	5			NONE			5			
	6			NONE			6			
Ì	7			NONE			7			

Figure 4 - 43: Delete Partition Page

Step 1. Choose the logical drive which has a partition you wish to delete, then press [ENTER].

Step 2. Choose "Partition logical drive." Partitions of the logical drive will be displayed in tabulated form.

Step 3. Move the cursor bar to the partition you wish to delete, then press [ENTER]. Enter "0" on the partition size to delete the partition.

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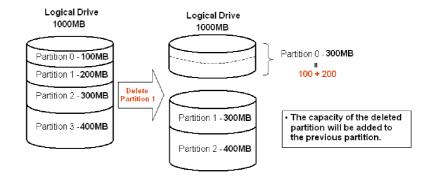


Figure 4-4: Drive Space Allocated to the Previous Partition

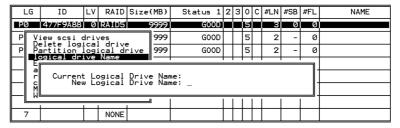
As illustrated above, the capacity of the deleted partition will be added to the previous partition.



Whenever a partition is changed, it is necessary to reconfigure all host LUN mappings. All data kept in the partition and the host LUN mappings will be removed with any partition change.

4.11.3 Assigning a Name to a Logical Drive

Naming can help identify different arrays in a multi-array configuration. This function is also useful in special situ ations. For example, when one or more logical drives have been deleted, the array indexing is changed after system reboot. The second logical drive might become the first on the list.



Step 1. Choose the logical drive for which you wish to assign a name, then press [ENTER].

Step 2. Choose "logical drive name," then press [ENTER] again. The current name will be displayed. You may now enter a new name in this field.

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Enter a name, then press [ENTER] to save the configuration. The number maximum characters for a logical drive name is 14.

4.11.4 Rebuilding a Logical Drive

If there is no spare drive in the system, a failed drive should be immediately replaced by a drive known to be good. Once the faile d drive is replaced, the following conditions may occur:

- 1. If the "Drive Check" mechanisms (such as "Periodic Drive Check" have been enabled, rebuild will start automatically.
- 2. If no "Drive Check" mechanisms have been configured, you need to manually initiate the rebuild process.

If you want the controller to auto-detect a replacement drive, make sure you have the following items set to "enabled":

Periodic Drive Check Time

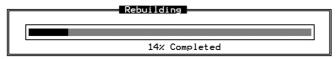
Periodic Auto-Detect Failure Drive Swap Check Time These two configuration options can be found under "View and Edit Configuration Parameters" -> "Drive-Side Parameters."

Manual Rebuild Process:

Q		ID	L۷	RAID	Size(MB)	Status	0	#LN	#SB	#FL	NAME
V	PØ	4149A729	NΑ	RAID5	19998	DRV FAILED	R	2	Ø	0	
~	P	View scs				GOOD	R	3	-	Ø	
ľ		Delete la Partition logical	n lo	ogical	drive						
5		Rebuild	log	cal d	ive						
`		c Rebui	ld l	ogica							
	5		Yes		No						
	6			NONE							
	7			NONE							

Step 1. Choose the logical drive that has a failed member drive, then press [ENTER].

Choose "Rebuild logical drive," then press [ENTER]. When prompted to "Rebuild Logical Drive?," select Yes.



The rebuild progress will be displayed in a status bar.

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Once rebuild has started, a *Rebuild progress* option will appear in the logical drive status menu, select the option to track its progress.



IMPORTANT!

The Rebuild function is only available when a logical drive with RAID level 1, 3, 5, or 6 has a failed member. NRAID and RAID 0 configurations provide no data redundancy.

4.11.5 Expand Logical Drive

If there is an amount of unused capacity in a logical drive, the LD can be expanded. If there is no available unused capacity, then the LD cannot be expanded.

To expand a logical drive, first select "Expand Logical Drive" selection. Press [Enter] to perform the option.

4.11.7 Add Drive

The Add Drive function will be thoroughly discussion in *Chapter 9* Array Expansion.

4.11.8 Regenerating Logical Drive Parity

(Applies to RAID Levels 1, 3, 5, and 6)

If no verifying method is applied to data writes, this function can often be performed to verify parity blocks of a selected array. This function compares and recalculates parity data to correct

LG	ID	LV	RAID	Size(MB)	Status	1	3	0	C	#LN	#SB	έFL	NAME
0 4	295529B	NA	RAID5	476000	GO	00	ı	4	В	3	0	0	
Ove Ger	cute Re ermrite : merate C	gent Inco heck	nate Insist Parit	ogical Dr ant Parity ty Error E	ive Pari - Enabl vent - E	ed nab	led		-				
3		П	NONE			I	Ī	Π	ĺ				
4			NONE			1	T	T					
5			NONE			7	T	Г	Г				
6			NONE			T	Ť	T					
7		П	NONE			_	Ť	T	T				

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Choose the logical drive that you want to regenerate the parity for, and then press [ENTER].



Choose "Regenerate Parity," then press [ENTER]. When prompted to "Regenerate Parity?," select Yes.

Please refer to *Chapter 8 Data Integrity* for more information on parity regeneration.

4.11.9 Media Scan

Media Scan examines drives and detects the presence of bad blocks. If any data blocks have not been properly committed and these faulty blocks are found during the scanning process, data from those blocks are automatically recalculated, retrieved and stored onto undamaged sectors. If bad blocks are encountered on yet another drive during the rebuild process, the block LBA (Logical Block Address) of those bad blocks will be shown. If rebuild is carried out under this situation, rebuild will continue with

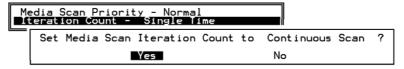
the ur	ne unaffected sectors salvaging the majority of the stored data hu Jun 16 18:31:36 2005 Cache Status: Clean												
	BAT:++++												
LG	ID	LV	RAID	Size(MB)	Status 1	2	3	0	С	#LN	#SB	#FL	NAME
PØ	PØ 6E448ADE NA NRAID 238214 GOOD 7 B 1 - 0												
- <u>T</u> t	Media Scan Priority - Normal Iteration Count - Single Time Task Scheduler												
3	8		NONE	8		L							
4			NONE										
5	5 NONE												
6			NONE										
7			NONE			I							

Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

There are two options with performing the Media Scan:

Media Scan Priority: determines how much of the system resources will be used for the drive scanning and recalculating process.

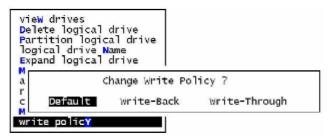
Iteration Count: determines how many times the scan is performed. If set to "continuous," the scan will run in the background continuously until it is stopped by a user.



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The subsystem firmware can automatically perform a Media Scan according to a preset task schedule. For more details, please refer to *Chapter 8 Data Integrity*.

4.11.10 Write Policy



The Write-back cache setting can be configured differently on each array. Setting to the default value means the array setting is coordinated with the subsystem's general setting. The general setting option can be found in "View and Edit Configuration Parameters" -> "Caching Parameters" -> "Write-Back"

Cache." Note that cached writes are lost if a power failure occurs and if the subsystem comes without a battery backup.

"Default" is more complicated and more likely equal to "not specified." Logical Drives' write policy not only depends on the subsystem's general setting but also on the Event Triggered operations. If set to "Default" and the subsystem's general write policy is set to "Write-back," write-back will be temporarily disabled in the event of component failure or abnormal working temperatures. "Write-back" mode will be restored once the faulty conditions are corrected.

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4.12 Viewing and Editing Host LUNs

4.12.1 Viewing or Deleting LUN Mappings

Before you proceed with host LUN mapping, you may need to create more host IDs under "View and Edit Channels."

Step 1. Choose the host channel and host ID combination you wish to view or delete.

				dr:	che Status: ite Cache: [Clean
Quick installation view and edit Logical drives	_		 Partiti			RAID
view and edit logical Volumes view and edit Host luns	<u> </u>		: Lun ?	0	9999	RAID5
v CHL Ø 1D Ø (Primary Controll v CHL Ø ID 1 (Secondary Contro v CHL 1 ID Ø (Primary Controll		Yes	No	_		
v CHL Ø ID 1 (Secondary Contro v CHL 1 ID 0 (Primary Controll 5 CHL 1 ID 1 (Secondary Contro v Edit Host-ID/WWN Name List	3					
	5					
	6					
	7					

17

Step 2

A list of the current LUN mappings will be displayed on the screen. Move the cursor bar to the LUN mapping you wish to delete, then press

[ENTER].

(7

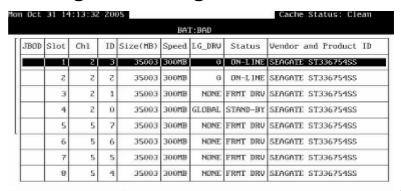
Step 3.

Select Yes to delete the LUN mapping, or No to cancel.

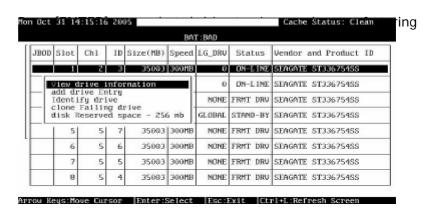
4.12.2 Edit Host ID/WWN Name List

This is a specific item used for systems communicating over Fibre host channels. Please refer to *Chapter 5 Fibre Operation* for more details.

4.13 Viewing and Editing Drives



oose "View and Edit Drives" in the Main Menu. All drives attached to the drive channels will be displayed on the screen.



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The disk drive-related functions include:

	Function	Description	Availability
1	View Drive Information	Displays disk drive information	Every drive type
2	Identify Drives	Lights disk drive LED for ease of identification	Every drive type
3	Clone Failing Drive	Disk-to-disk cloning fo r maintenance purposes or simply produces a clone	Members of logical drives
4	Delete Global/Local Spare Drive	Deletes a pre-configured Spare Drive	Global/Local/Enclosure Spare drive
5	Add Global/Local/ Enclosure Spare Dri	Assigns a drive as a hot- spare	Non-configured drives (used/new drives)
6	ve Media Scan	Performs drive integrity scan	Non-configured drives; the "Media Scan " function on drive me mbers can be found in t he "View and Edit Logi
7	Drive Utilities: Read/Write Test	Low-level read/write test	cal Drives" menu. New drives.
8	Disk Reserved Space	Unformat the 256MB reserve d space; this can return a "use d drive" to the "new" drive status	View-only on member drives, reserved space r emovable on the used o r formatted disk drives (those that were previo usly included in logical drive configurations)

The use of the Media Scan function is described the *Data Integrity* chapter. Details on the use of "Clone Failing Drive" can be found in *Chapter 8*. The Drive Utilities function is discussed in the last section of this chapter.

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4.13.1 Deleting Spare Drive (Global / Local Spare Drive)

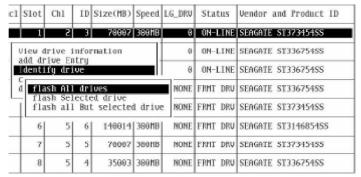
Move the cursor to a Local, Global, or Enclosure Spare Drive, Choose "Delete Global/Local/Enclosure [FNTFR] Encl Slot Chl ID Size(MB) Speed LG_DRV Status Vendor and Product ID onfirm. ON-LINE SEAGATE ST3734545S View drive information Delete global/local spare drive ON-LINE SEAGATE ST336754SS add drive Entry Identify drive ON-LINE SEAGATE ST336754SS mediñ scan disk Reserved space - 256 mb ONE FRMT DRU SEAGATE ST336754SS 5 7 70807 300MB GLOBAL STAND-BY SEAGATE ST373454SS 140014 386MB MONE FRMT DRU SENGATE ST3146854SS FRMT DRU SEAGATE ST373454SS 5 5 20807 380MB NONE R 35863 386MB NONE FRMT DRU SEAGATE ST336754SS 5



The spare drive you deleted (disassociated or reassigned as a normal disk drive) or any drive you replaced from a logical unit will be indicated as a "used drive."

4.13.2 Disk Reserved Space

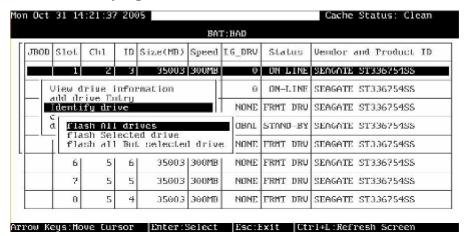
The 256MB reserved space can be removed from a disk drive once the drive is excluded from a logical drive. The reserved space, a space formatted with a micro-file system, can also be manually created from a new disk drive.



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4.13.3 Identifying Drives



Whenever there is a failed drive in a logical drive configuration, make it a point to replace the failed drive with a new, healthy drive to ensure logical drive integrity.

If you replaced the wrong drive when trying to replace a failed drive you will no longer be able to access the logical drive because you have inadvertently failed another drive.

To prevent this from happening, the controller provides an easy way to identify the faulty drive. By forcing certain drive LEDs to light for a configurable period of time, the faulty drive can be identified, and thus reduce the chance of removing the wrong drive. This function can be especially helpful in an installation site operating with hundreds of disk drives.

4.13.3.1 Flash Selected Drive

The Read/Write LED of the particular drive you selected will light steadily for a configurable period of time, from 1 to 999 seconds.

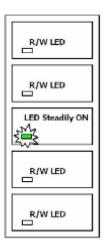
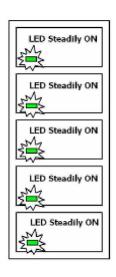


Figure 4-5: Flash Selected Drive

4.13.3.2 Flash All Drives

The Read/Write LEDs of all connected drive s will light for a configurable period of time. If the LED of the defective drive did not lig ht on the "Flash Selected Drive" function, u se "Flash All Drives" to verify the fault (the drive tray itself may have failed!). If the "Fl ash All Drives" function is executed, and the defective drive's LED still does not respond, it can be a drive tray problem or the drive is dead.



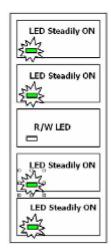


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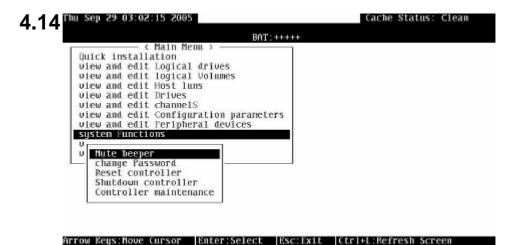
4.13.3.3 Flash All but Selected Drives

Except the selected drive, the Read/Write LE Ds of all connected drives will light for a configurable period of time ranging from 1 to 999 seconds. If an administrator cannot be sure of the exact location of a specific drive, this function will help to indicate where it is. This can prevent removal of the wrong drive when a drive fails and is about to be replaced.



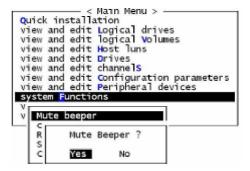


The drive-identifying function can be selected from "Main Menu"/"View and Edit Drives"/"Identify Drives."



Choose "System Functions" in the Main Menu, then press [ENTER] to display the System Functions menu. Move the cursor bar to an item, then press [ENTER].

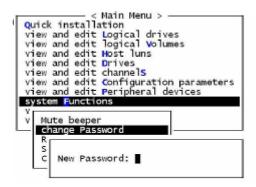
4.14.1 Mute Beeper



When the subsystem's beeper (onboard alarm) has been activated, choose "Mute Beeper," then press [ENTER]. Choose Yes and press [ENTER] in the next dialog box to turn the beeper off temporarily for the current event. The beeper will still be activated by the next event.

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4.14.2



Use the subsystem's password to protect the array from unauthorized entry. Once the subsystem password has been set, regardless of whether the front panel, the RS-232C terminal interface or RAIDWatch Manager is used, you can only access the subsystem by providing the correct password.



IMPORTANT!

1.

The controller verifies the password when entering the Main Menu from the initial screen or when making a configuration change . If the controller is going to be left unattended, the "Password Validation Timeout" can be set to "Always Check." Setting the validation timeout to "Always Check" will protect the controller configuration from any unauthorized access.

2. The controller password and controller name share a 16-character space. The maximum numbers of characters for the controller password is 32. If the controller name occupies 32 characters, there is only one character left for the controller password, and vice versa.

4.14.3 Changing the Password

To set or change the controller password, move the cursor bar to "Change Password," then press [ENTER].

If a password has previously been set, the controller will ask for the o ld password first. If the password has not yet been set, the controller will directly ask for the new password. The password cannot be replaced unless the correct old password is provided.

Key-in the old password, then press [ENTER]. If the password is incorrect, it will not allow you to change the password. Instead, it will display the message "Password incorrect!," then go back to the previous menu.

If the password is correct, or there is no preset password, it will ask for a new password.

4.14.4 Softing at Normal Marina Soword view and edit Logical drives view and edit logical Volumes view and edit Host luns view and edit Scsi Drives view and edit Scsi channels view and edit Configuration parameters view and edit Peripheral devices system Functions V Mute beeper change Password: C New Password:

Enter the desired password in the column, then press [ENTER]. The next dialog box will display "Re-Enter Password." Enter the password again to confirm and press [ENTER].

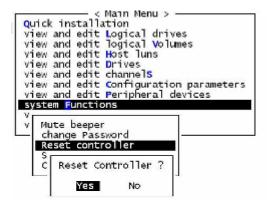
The new password will now become the controller's password. Providing the correct password is necessary when entering the Main Menu from the initial screen.

4.14.5 Disabling the Password

To disable or delete the password, press [ENTER] in the empty column that is used for entering a new password. The existing password will be deleted. No password checking will occur

when entering the Main Menu or when m4aking a configuration change.

4.14.6



To reset the controller without powering off the system, move the cursor bar to "Reset Controller," then press [ENTER]. Choose Yes

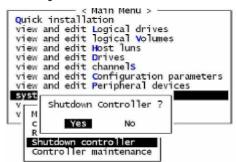
in the dialog box that follows, then press [ENTER]. The controller will now reset.



Before resetting or powering off the RAID controller (subsystem) it is advised you execute the Shutdown Controller function to flush the cache contents in the memory in order to reduce the chance of encountering data inconsistency.

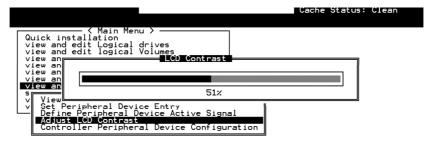
4.14.7 Shutdown Controller

Before powering off the controller, unwritten data may still reside in cache memory. Use the "Shutdown Controller" function to f lush the cache content. Move the cursor bar to "Shutdown Controller," then press [ENTER]. Choose Yes in the dialog box that f ollows, then press [ENTER]. The controller will now flush the cache memory.



For Controller Maintenance functions, such as "Download Firmware," please refer to *Appendix B*.

4.14.8 Adjust LCD Contrast

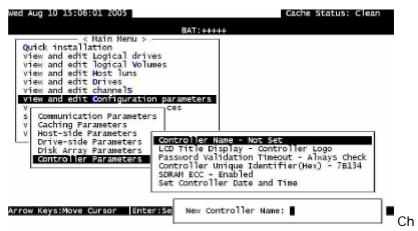


The controller LCD contrast lesc:Exit lCtrl+L:Refresh Screen
The controller LCD contrast is set at the factory to a level
that should be generally acceptable. If changes are required,
the controller is equipped with an LCD contrast adjustment
circuit,

allowing the contrast to be adjusted either via the RS-232 Terminal Emulation Menus or by the LCD User Interface.

4.15 Controller Parameters

4.15.1 Controller Name



oose "View and Edit Configuration Parameters," "Controller Parameters," then press [ENTER]. The current name displays. Press [ENTER]. Enter a name in the dialog box that prompts, then press [ENTER].

The controller name represents a RAID subsystem in a topology that consists of numerous RAID subsystems.

4.15.2 LCD Title Display - Controller Name



Choose "View and Edit Configuration Parameters," "Controller Parameters," then press [ENTER]. Choose to display the

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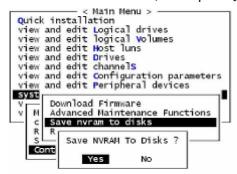
embedded controller logo or any given name on the LCD. Giving a s pecific name to each controller will make them easier to identify if yo u have multiple RAID systems remotely monitored.

4.15.3 Saving NVRAM to Disks

You can choose to backup your controller-dependent configuration in formation to disks. We recommend using this function to save configuration information whenever a configuration change is made. The information will be duplicated and distributed to all logical configurations of drives.

At least a RAID configuration must exist for the controller to write your configuration data onto it.

From the Main Menu, choose "System Functions." Use the arrow keys to scroll down and select "Controller Maintenance," "Save NVRAM to Disks," then press [ENTER].



Choose Yes to confirm.

A prompt will inform you that NVRAM information was successfully saved.

4.15.4 Restore NVRAM from Disks

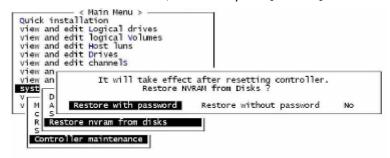


CAUTION!

The Restore NVRAM is a function that carries some risks. Firmware restoration will not destroy the existing logical drive configurations; however, if the existing logical drives cannot be adequately associated with host ID/LUNs after NVRAM restoration, host might not be able to access your configured arrays.

Use this function to restore your NVRAM information that you previously saved onto disk.

From the Main Menu, choose "System Functions." Use the arrow keys to scroll down and select "Controller Maintenance," "Re store NVRAM from disks," and then press [ENTER].





CAUTION!

In case your previous password (reserved at the time you saved your NVRAM configuration contents) is different from your current password, you are provided with the options whether to restore the password you previously saved with your configuration profile.

Press [ENTER] on one of the selections to confirm.

A prompt will notify you that the controller NVRAM data was successfully restored from disks.

4.15.5 Password Validation Timeout



Choose "View and Edit Configuration Parameters," "Controller Parameters," then press [ENTER]. Select "Password Validation Timeout," and press [ENTER]. Choose to enable a validation timeout from "1 minute" to "Always Check." The Always Check timeout will disable any configuration change made without entering the correct password.

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4.15.6 Controller Unique Identifier



Usually every RAID subsystem/controller comes with a default ID. In rare occasions should this identifier be changed.



r any hex number between "0" and "FFFFF" for the unique identifier. The value you enter *MUST* be different for each controller.

Every Falcon III / Magellan / X4 subsystem comes with a default ID. This ID should

be sufficient for avoiding WWNN and WWPN conflict.

A unique ID is required for every RAID subsystem whether it is configured in a single- or dual-controller configuration. The unique ID is necessary for the following reasons:

- 1. A specific identifier helps RAID controllers to identify their counterpart in a dual-active configuration.
- 2. The unique ID is generated into a Fibre Channel WWN node name for RAID controllers or RAID subsystems using Fibre Channel host ports. The node name prevents host computers from misaddressing the storage system during the controller failover/failback process in the event of single controller failure.
- The unique ID is also generated into a MAC address for the controller's Ethernet port. The MAC address will be taken

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over by a surviving controller in the event of single RAID controller failure.

4. When a controller fails and a replacement is combined as the secondary controller, the FC port node names and port names will be passed down to the replacement controller. The host will not acknowledge any differences so that controller failback is totally transparent.

The unique identifier setting can be accessed from "View and Edit Configuration Parameters" -> "Controller Parameters" -> "Controller Unique ID."

4.15.7 Set Controller Date and Time

This sub-menu only appears when the subsystem/controller is equipped with a real-time clock.

Time Zone



The controller uses GMT (Greenwich Mean Time), a 24-hour clock. To change the clock to your local time zone, enter the numbers

of hours later than the Greenwich Mean Time after a plus (+) sign. For example, enter "+9" for Japan's time zone.

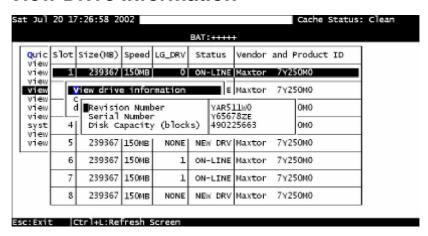
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Date and Time



Enter time and date in its numeric representatives in the following order: month, day, hour, minute, and the year.

4.16 View Drive Information



From the "View and Edit Drives" menu, select the drive that the utility is to be performed on, then press [ENTER]. Select "View drive information," then press [ENTER].

4.17 Drive Utilities

4.17.1 Drive Read/Write Test

From the "View and Edit Drives" menu, select a "new" or "used" drive that the utility is to be performed on, then press [ENTER]. Select "Drive Utilities," then press [ENTER]. Choose "Read/Write Test" and press [ENTER]. You can choose to enable/disable the following options:

f Ready-Write Test Type:

Two types are available: Ready-Only and Read + Write

Action on Detection of Errors:

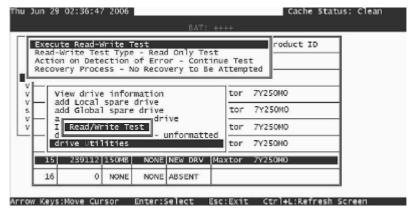
- Continue Test
- Abort on Detection of Any Errors (including hardware, media errors, etc.)
- Abort on Detection of Hard Errors only (including only hardware errors defined by SATA 8-bit encoding)

Recovery Process:

- No Recovery
- Mark Block Bad (Mark the affected blocks as bad)
- Reassignment (try to reassign data residing on the affected sectors)
- First Try Reassignment (Operate by attempting to reassign and mark bad if the reassignment attempt fails)

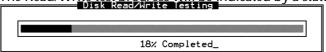
f Execute Drive Testing

4-58 RAID, Inc.

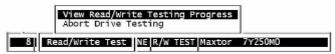


When finished with the configuration, select "Execute Drive Testing" and press [ENTER] to proceed.

The Read/Write test progress will be indicated by a status bar.



You may press [ESC] and select "Read/Write Test" later and choose to "View Read/Write Testing Progress." If you want to stop testing the drive, select "Abort Drive Testing" and press [ENTER] to proceed.





IMPORTANT!

The disk drive on which a read/write test will be performed cannot be a spare drive (local or global) or a member of a logical drive. The "Read/Write Test" option will not appear if the drive is not indicated as a "New Drive" or a "Used Drive." Also, a drive formatted with a 256MB reserved space is also excluded from selection.

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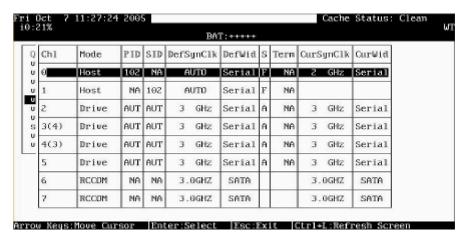
4-60 RAID, Inc.

5

Fibre Operation

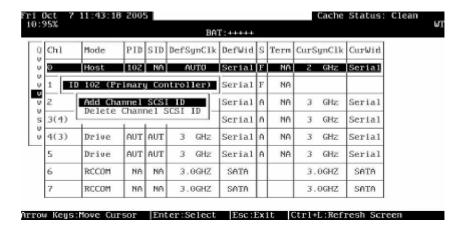
5.1 Viewing and Editing Channels

Falcon III / Magellan / X4 subsystems come with preset data paths and there is no need to modify channel configurations, e.g., channel mode.



Choose "View and Edit Channels" in the Main Menu to display channel status.

Fibre Operation 5-1



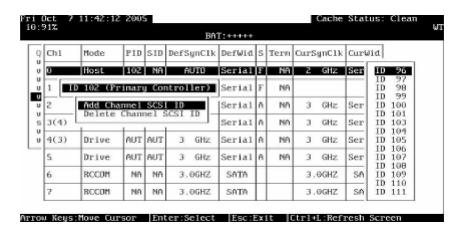


IMPORTANT!

Most Falcon III / Magellan / X4 subsystems have preset host, drive, and RCC channels that cannot be changed. The channel mode option will not be

available on the subsystem models.

5.1.1 Viewing and Editing IDs - Host Channel





Step 1. Choose a host channel, then press [ENTER].



Choose "View and Edit ID." A list of existing ID(s) will be displayed on the screen.



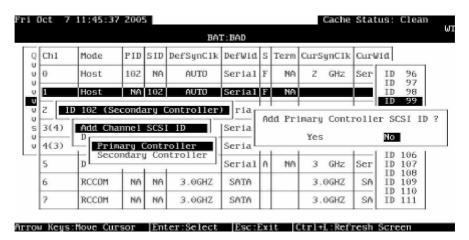
Select one of the existing IDs and press [ENTER]. You may then choose to add a new ID or delete an existing ID.

5-2 RAID, Inc.

Limitation:

If host connection is configured in an arbitrary loop, FC-AL mode, the maximum number of IDs is "16."

5.1.2 Adding an ID (Primary/Secondary Controller ID)



In a single-controller mode, you should set the secondary controller's ID to "NA" (usually unavailable in a single-controller subsystem). In a dual-controller configuration, you may need to create a Secondary Controller ID on your host channels.

Once Secondary Controller IDs are available, you can associate logical arrays with them so that the workload can be shared between partner RAID controllers.



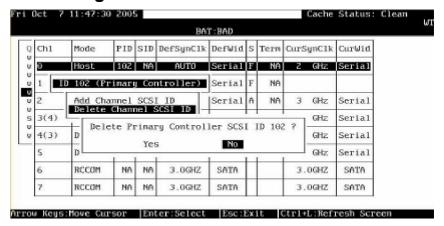
Press [ENTER] on one of the existing IDs. Choose "Add Channel SCSI ID," then choose to designate an ID as either the "Primary Controller" ID or "Secondary Controller" ID.



A list of channel IDs will appear. Choose an ID from the pull-down list. In a redundant-controller configuration, logical drives associated with a Primary ID will be managed by the Primary controller, and a logical drive associated with a Secondary ID managed by the Secondary controller.

Fibre Operation 5-3

5.1.3 **Deleting an ID**





Step 1. Choose the host bus ID you wish to delete. Choose "Delete Channel ID."



The dialog box "Delete ID#?" will appear. Select Yes, then press [ENTER] to confirm.



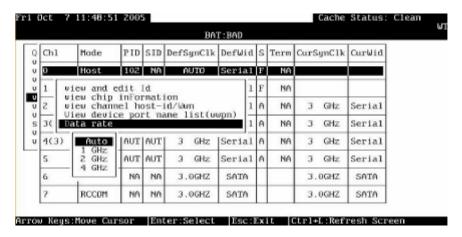
IMPORTANT!

- Every time you add/delete a channel ID, you must reset the subsystem/controller for the changes to take effect.
- Multiple target IDs can co-exist on a host channel while every drive channels in a dual-controller subsystem has two preset IDs.
- At least one ID should be available on each channel bus.

For details on ID settings in configurations using redundant RAID controllers, please refer to Chapter 12 Redundant Controller.

RAID, Inc. 5-4

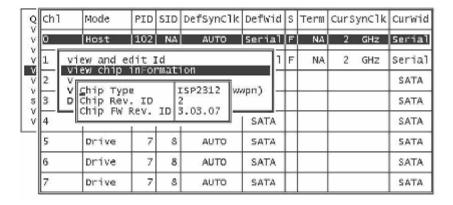
5.1.4 Data Rate (Channel Bus)



This option is available in the configuration menu of Fibre host channel and of the drive channel configuration menus in Fibre-, SAS-, or SATA-based subsystems. Default is "AUTO" and should work fine with most disk drives. Changing this setting is not recommended unless some particular bus signal issues occur.

The host channel data rate setting allows a 4Gbit or 2Gbit Fibre Channel to negotiate with devices communicating over 2GHz or 1GHz link if the link speed configuration is determined externally.

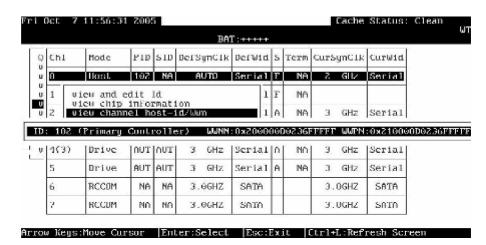
5.1.5 View Chip Information



This is a view only option showing basic information about each of the host/drive chip processor.

Fibre Operation 5-5

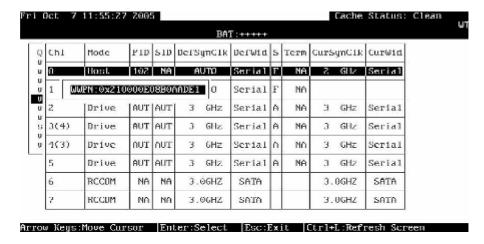
5.1.6 View Channel Host ID/WWN



Port name is a unique eight-byte address assigned to an FC device port.

The subsystem has multiple channels (I/O paths) and each channel is managed by an I/O processor. This function allows users to inspect the node names and port names assigned to these chip processors. Some management software running on host computers needs these names to properly address a storage subsystem.

5.1.7 View Device Port Name List (WWPN)



This function displays the device port names (host adapter WWN) detected on a host loop or through fabric host connection.

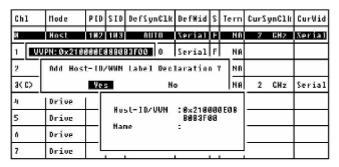
The HBA port names detected can be added to the "Host-ID WWN name list" in "View and Edit Host LUN" menu. Adding port names to the list can speed the mapping process that follows.

5-6 RAID, Inc.

Each port name can then be assigned a nickname for ease of identification.

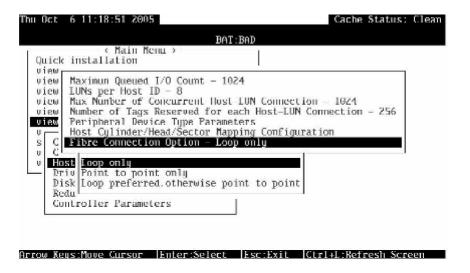
5.1.8 Add Host – ID/WWN Label Declaration

A nickname can be appended to any host adapter WWN for ease of identification in environments, e.g., SAN, where multiple servers reside in a storage network.



Press [ENTER] on a displayed adapter WWPN and you will be prompted with a confirm box as shown above. Choose Yes and enter a name for the host adapter port.

5.2 Fibre-related Host-side Parameters



5.2.1 Fibre Channel Connection Option:

Use the ↑ ↓ keys to scroll down to "View and Edit Configuration Parameters," "Host-side Parameters," and then "Fibre Connection Option." A prompt will display all options. Select one appropriate for your Fibre Channel topology.

Fibre Operation 5-7

If subsystem host ports are directly connected to host HBAs, select the "Point-to-Point" mode.

For a switched fabric configuration, a redundant controller system can be connected to host computers via FC switches regardless of host port settings.

5.2.2 Controller Unique Identifier



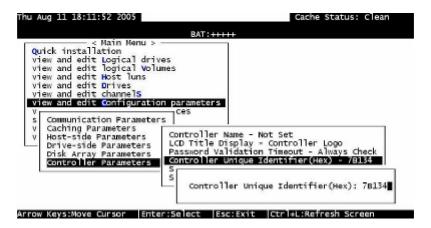
A Controller Unique Identifier is *required* for operation with the *Redundant Controller Configuration*. All Falcon III / Magellan / X4 subsystems come with a preset identifier.

The unique identifier will be used to generate a Fibre Channel "node name" (WWNN). The node name is device-unique and comprised of information such as the IEEE company ID and this user-configurable identifier in the last two bytes.

In redundant mode, the controller configuration data is continuously synchronized between controllers. Host ports on both controllers appear with the identical node names and each with a different port name (WWPN). When a controller fails and a replacement is combined, the node name will be passed down to the replacement, making the host unaware of controller replacement so that the controller failback process can complete in a host-transparent manner.

All Falcon III / Magellan / X4 subsystems come with a default identifier. This identifier guarantees your FC ports' port names and node names are unique over a Fibre Channel network. Making changes to the default value is only necessary if the port name conflicts should occur.

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The unique identifier can also be accessed from "View and Edit Configuration Parameters" -> "Controller Parameters" -> "Controller Unique Identifier (Hex)."

Fibre Operation 5-9

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6

Host-side and Drive-side Parameters

This chapter discusses the advanced options for configuring and maintaining a RAID subsystem. Each function is given a brief explanation as well as a configuration sample. Terminal screens are used in the configuration samples. Some of the operations require basic knowledge of RAID technology and are only recommended for an experienced user.



NOTE:

All figures in this chapter are showing examples using the management hyper terminal screen.

6.1 Host-side Parameters

The highly scalable Fibre Channel technology can address up to 126 devices per loop, and theoretically more than a million over FC switches. Each configured disk drive array is associated with a host ID and presented to the host as contiguous volume.

If you file a document into a cabinet, you must put the document into one of the drawers. From a Fibre's point of view, a Fibre channel ID is like a cabinet, and the drawers are the LUNs (Logical units). Each Fibre channel ID enables up to 32 LUNs and up to 1024 LUNs are configurable per controller. Data can be stored into one of the LUNs of the Fibre channel ID. Most Fibre host adapters treats a LUN like another Fibre device.



Figure 6 - 1: ID and LUNs as a Cabinet and Drawers

6.1.1 Maximum Concurrent Host LUN Connection ("Nexus" in SCSI)

The configuration option adjusts the internal resources for use with a number of current host nexus. If there are four host computers (A, B, C, and D) accessing the array through four host IDs/LUNs (ID 0, 1, 2 and 3), host A through ID 0 (one nexus), host B through ID 1 (one nexus), host C through ID 2 (one nexus) and host D through ID 3 (one nexus) - all queued in the cache - that is called 4 nexus. If there are I/Os in the cache through four different nexus, and another host I/O comes down with a nexus different than the four in the cache (for example, host A access ID 3), the controller will return "busy." Note that it is "concurrent" nexus; if the cache is cleared up, it will accept four different nexus again. Many I/Os can be accessed via the same nexus.

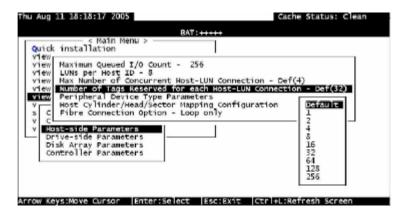


From the Main Menu, select "View and Edit Configuration Parameters," "Host-side Parameters," then press [ENTER]. Choose "Max Number of Concurrent Host-LUN Connection," then press [ENTER]. A list of available selections will appear. Move cursor bar to an item, then press [ENTER]. Choose Yes in the dialog box that follows to confirm your setting. The default is "4."

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6.1.2 Number of Tags Reserved for Each Host-LUN Connection

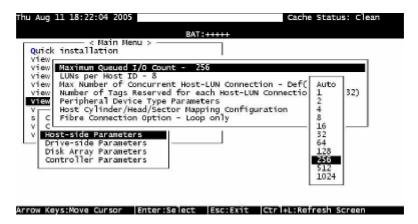
Each nexus has 32 (the default setting) tags reserved. When the host computer sends 8 I/O tags to the controller, and the controller is too busy to process them all, the host might start to send less than 8 tags during every certain period of time since then. This setting ensures that the controller will accept at least 32 tags per nexus. The controller will be able to accept more than that as long as the controller internal resources allow - if the controller does not have enough resources, at least 32 tags can be accepted per nexus.



Choose "Host-side Parameters," then press [ENTER]. Choose "Number of Tags Reserved for each Host-LUN Connection," then press [ENTER]. A list of available selections will appear. Move the cursor bar to an item, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

6.1.3 Maximum Queued I/O Count

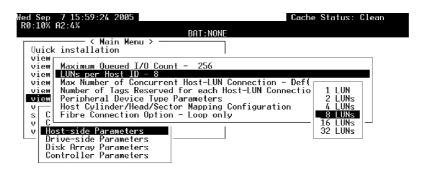
This function allows you to configure the maximum queued I/O count the controller can receive from the host computer.



Choose "Host-side Parameters," then press [ENTER]. Choose "Maximum Queued I/O Count," then press [ENTER]. A list of available selections will appear. Move the cursor bar to an item, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

The controller supports the following Host-side configurations: "Maximum Queued I/O Count," "LUNs per Host ID," "Num of Host-LUN Connect," "Tag per Host-LUN Connect," "Peripheral Dev Type Parameters," and "Cyl/Head/Sector Mapping Config."

6.1.4 LUNs per Host ID



Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

Choose "LUNs per Host ID," then press [ENTER]. A list of selections will appear. Move the cursor bar to an item, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

6.1.5 LUN Applicability

If no logical drive has been created and mapped to a host LUN, and the RAID controller is the only device connected to the host SCSI card, usually the operating system will not load the driver for the host adapter. If the driver is not loaded, the host computer will not be able to use the in-band utility to communicate with the RAID controller. This is often the case when users want to start configuring a RAID using management software from the host. It will be necessary to configure the "Peripheral Device Type" setting for the host to communicate with the controller. If the "LUN-0's only" is selected, only LUN-0 of the host ID will appear as a device with the user-defined peripheral device type. If "all undefined LUNs" is selected, each LUN in that host ID will appear as a device with the user-defined peripheral device type.

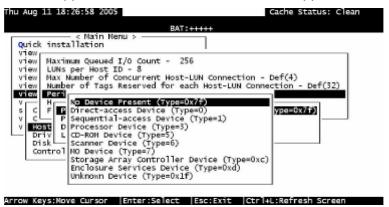
Different "LUN applicability" selections are available: "Device Type" selection, "Device Qualifier Support," "Support Removable

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media," "LUN-0's only," and "All undefined LUNs." Please refer to 6.1.8 Peripheral Device Type Parameters for Various Operating Systems for details concerning various operating systems.

6.1.6 Peripheral Device Type

For connection without a pre-configured logical unit and Ethernet link to a host, the in-band SCSI protocol can be used in order for the host to "see" the RAID subsystem. Please refer to the reference table below. You will need to make adjustments in the following submenus: Peripheral Device Type, Peripheral Device Qualifier, Device Support for Removable Media, and LUN Application.



6.1.7 In-band

External devices (including a RAID subsystem; from the view of operation on an application server or management PC) require communication links with a management computer for device monitoring and administration. In addition to the regular RS-232C or Ethernet connection, in-band SCSI can serve as an alternative means of management communications. In-band SCSI translates the original configuration commands into standard SCSI commands. These SCSI commands are then sent to and received by the controller over the existing host links, either SCSI or Fibre.

6.1.8 Peripheral Device Type Parameters for Various Operating Systems



IMPORTANT!

There is no need to configure the Peripheral Device setting if you are trying to manage a RAID subsystem from a RAIDWatch station through an Ethernet connection (to the Falcon III / Magellan / X4

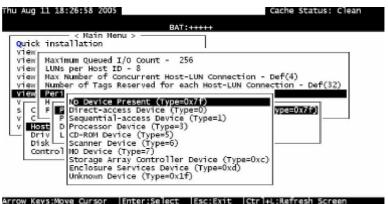
subsystem's Ethernet

With an in-band connection, a host computer cannot "see" a RAID controller UNLESS the following have been configured:

- 1. (a) A logical unit has been created.
 - (b) At least one logical unit is mapped to a host ID or LUN via the RS-232/LCD keypad interface.
- 2. (a) Host bus connection is established.
 - (b) The RAID subsystem/controller is configured to appear as a peripheral device on the channel bus connected to a host computer.

With a brand new array, there is no association between disk drive configurations and the logical ID/LUN presentations on the host bus. If users want to start configuring a RAID system from an application server before any RAID configuration is made, the host will not be able to "see" the RAID subsystem. In order for a host to "see" the subsystem, it will be necessary to define the controller/subsystem as a peripheral device.

Different host operating systems require different adjustments. See the tables below to find the proper settings for your host operating system. References to "Peripheral Device Qualifier" and "Device Support for Removable Media" are also included.



Operating System	Peripheral Device Type	Peripheral Device Qualifier	Device Support for Removable Media	LUN Applicability
Windows 2000/2003	0xd	Connected	Either is okay	LUN-0's
Solaris [™] 8/9 (x86 and SPARC)	0xd	Connected	Either is okay	LUN-0's
Linux	0xd	Connected	Either is	LUN-0's

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RedHat 8/9;		okay	
SuSE 8/9			

Table 6 - 1: Peripheral Device Type Parameters

Device Type	Setting	
Enclosure Service Device	0xd	
No Device Present	0x7f	
Direct-access Device	0	
Sequential-access Device	1	
Processor Type	3	
CD-ROM Device	5	
Scanner Device	6	
MO Device	7	
Storage Array Controller Device	0xC	
Unknown Device	0x1f	

Table 6 - 2: Peripheral Device Type Settings

6.1.9 Cylinder/Head/Sector Mapping

Drive capacity is decided by the number of blocks. For some operating systems (Sun Solaris, for example) the capacity of a drive is determined by the cylinder/head/sector count. For Sun Solaris, the cylinder cannot exceed 65535; choose "cylinder<65535," then the controller will automatically adjust the head/sector count for your OS to read the correct drive capacity. Please refer to the related documents provided with your operating system for more information.

Cylinder, Head, and Sector counts are selectable from the configuration menus shown below. To avoid any difficulties with a Sun Solaris configuration, the values listed below can be applied.

Capacity	Cylinder	Head	Sector
< 64 GB	variable	64	32
64 - 128 GB	variable	64	64
128 – 256 GB	variable	127	64
256 – 512 GB	variable	127	127
512 GB - 1 TB	variable	255	127

Table 6 - 3: Cylinder/Head/Sector Mapping under Sun Solaris

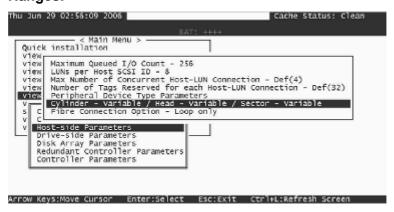
Older Solaris versions do not support drive capacities larger than 1 terabyte.

Solaris 10 now supports array capacity larger than 1TB. Set the values to the values listed in the table below:

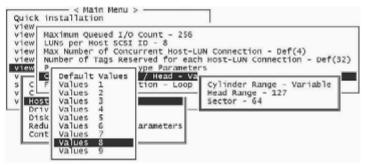
Capacity	Cylinder	Head	Sector
>1TB	<65536	255	variable
		variable	255

Table 6 - 4 Cylinder/Head/Sector Mapping under Sun Solaris 10

Configuring Sector Ranges/Head Ranges/Cylinder Ranges:

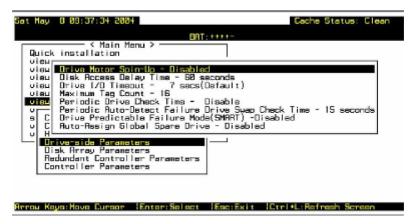


The sector, head, and cylinder variables are presented as preset combinations. Please refer to the documentation that came with your operating system and select one value set that is most appropriate for your OS.



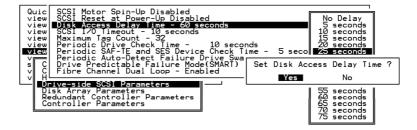
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6.2 Drive-side Parameters:



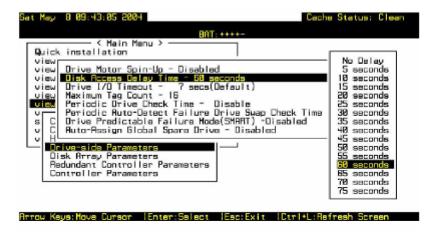
Choose "Drive-side SCSI Parameters," then press [ENTER]. The Drive-side SCSI parameters menu displays.

6.2.1



6.2.2 Disk Access Delay Time

This feature sets the delay time before the subsystem tries to access the hard drives after power-on. Default may vary from 15 seconds to 30 seconds, and from one model to another. This parameter can be adjusted to fit the spin-up speed of different models of disk drives installed in your subsystem.



Choose "Disk Access Delay Time," then press [ENTER]. A list of selections displays. Move the cursor bar to a selection, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

6.2.3 Drive I/O Timeout

The "Drive I/O Timeout" is the time interval for the controller to wait for a drive to respond. If the controller attempts to read data from or write data to a drive but the drive does not respond within the Drive I/O Timeout value, the drive will be considered as a failed drive.

When the drive itself detects a media error while reading from the drive platter, it usually retries the previous reading or re-calibrates the head. When the drive encounters a bad block on the media, it reassigns the bad block onto a spare block. However, it takes time to perform the above actions. The time to perform these operations can vary between different brands and different models.

During channel bus arbitration, a device with higher priority can utilize the bus first. A device with lower priority will sometimes receive an I/O timeout when devices of higher priority keep utilizing the bus.

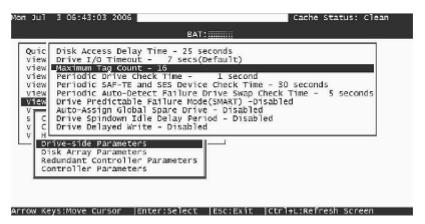
The default setting for "Drive I/O Timeout" is 7 seconds. It is highly recommended not to change this setting. Setting the timeout to a lower value will cause the controller to judge a drive as failed while a drive is still retrying, or while a drive is unable to arbitrate the drive bus. Setting the timeout to a greater value will cause the controller to keep waiting for a drive, and it may sometimes cause a host timeout.

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Choose "Drive I/O Timeout –Default (7 seconds)," then press [ENTER]. A list of selections will appear. Move the cursor bar to a selection, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

6.2.4 Maximum Tag Count: Tag Command Queuing (TCQ) and Native Command Queuing (NCQ) Support



This sub-menu facilitates the support for both Tagged Command Queuing (TCQ) and Native Command Queuing (NCQ). TCQ is a traditional feature on SCSI, SAS, or Fibre disk drives, while NCQ is recently implemented with SATA disk drives. The queuing feature requires the support of both host adapters and hard disk drives. Command queuing can intelligently reorder host requests to streamline random accesses for IOPS/multi-user environments.

RAID, Inc.'s subsystems support tag command queuing with an adjustable maximum tag count from 1 to 128. The default setting is "Enabled" with a maximum tag count of 32 (SCSI, SAS, or Fibre drives) or 16 (default for SATA drives). Choose "Maximum Tag Count", then press [ENTER]. A list of available tag count numbers displays. Move the cursor bar to a number, then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.



IMPORTANT!

- f Every time you change this setting, you must reset the controller/subsystem for the changes to take effect.
- f Disabling Tag Command Queuing will disable the hard drives' built-in cache for Write-Back operation.



NOTE:

The following options are categorized as related to array maintenance and data integrity:

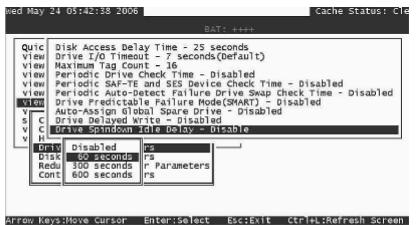
- Periodic Drive Check Time
- Periodic Auto-Detect Failure Drive Swap Check Time
- Auto-Assign Global Spare Drive

Details of these options can be found in Chapter 11.

Another option is associated with disk drive SMART support and details can be found in Chapter 13:

Drive Predictable Failure Mode (SMART)

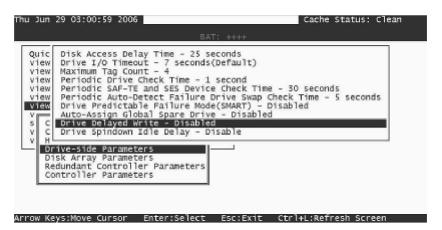
6.2.5 Drive Spindown Idle Delay Period



Subsystem firmware stops supplying 12V power source to hard drives when hard drives have not received I/Os for a period of time. When enabled, this feature helps reduce power consumption.

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6.2.6 Drive Delayed Write



This option applies to disk drives which come with embedded buffers. When enabled, write performance may improve. However, this option should be disabled for mission-critical applications. In the event of power outage or drive failures, data cached in drive buffers may be lost, and data inconsistency will occur.

Following are the defaults for different storage configurations:

- f On dual-controller models, the default is "Disabled."
- f On single-controller models, the default is "Enabled."

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Enclosure Management

This chapter discusses the configuration options related to enclosure monitoring. Each function is given a brief explanation as well as a configuration sample. Terminal screens will be used in the configuration samples. Some of the operations require basic knowledge of RAID technology and are only recommended for an experienced user.



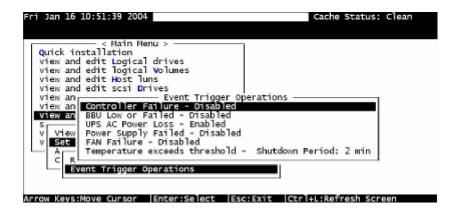
NOTE:

All figures in this chapter are showing examples from a hyper terminal console.

7.1 **Enclosure Monitoring**

Enclosure Devices 7.1.1

7.1.1.1 Event Triggered Operations





Step 1.

Use arrow keys to move your cursor bar to select "View and Edit Peripheral Devices" on the Main Menu and press [ENTER].



Step 2.

Choose "Set Peripheral Device Entry", press [ENTER], then select "Event Trigger Operations" by pressing [ENTER]. The event trigger menu displays.



Step 3.

Select any of the monitoring elements by moving the cursor bar and pressing [ENTER] to enable or disable the association with related system events.





NOTE:

The last condition, the "Temperature Threshold," is associated with a configurable time buffer before an automatic shutdown. Please refer to the next section for details.

Operation Theory:

The Operation:

To reduce the chance of data loss due to hardware failure, the controller/subsystem automatically commences the following actions when a component failure is detected:

- 1). Switches its caching mode from "write-back" to the conservative "write-through."
- 2). Flushes all cached data.
- 3). Raises the rotation speed of cooling fans.

The Trigger:

The mode-switching and cache-flush operations can be triggered by the detection of the following conditions:

 Controller failure (Redundant-controller Models)
 If a controller fails in a dual-redundant controller configuration, the surviving controller no longer has

7-2 RAID, Inc.

the protection of synchronized cache by having the replica of unfinished writes in its partner.

2. BBU low or failed:

If a battery fails or is under-charge, the unfinished writes cannot be supported if power outage occurs.

3. UPS AC power loss:

Even with the buffer provided by the UPS, if power outage occurs, cached data should be immediately distributed to hard drives before the battery charge in UPS runs out.

- 4. Power supply failure
- 5. Fan failure
- 6. Temperature exceeds threshold

If one or more of the event triggers are enabled, the occurrence of the above conditions forces the controller/subsystem to adopt the "write-through" caching mode. Once the faulty condition is corrected, the controller/subsystem automatically restores the previous caching mode.





NOTE:

The temperature thresholds refer to those set for both sensors on the RAID controller boards and those placed within the subsystem enclosure. In terms of the controller temperature, board 1 refers to the main circuit board and board 2 refers to the second-level I/O board or the daughter card. If any of the threshold values set for any sensor is exceeded, the trigger automatically applies.



NOTE:

If a battery is not installed in your RAID subsystem, the "BBU Low or Failed" option should be disabled.

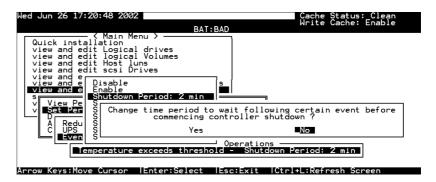
7.1.2 Auto Shutdown on Elevated Temperature

System components can be damaged if operated under elevated temperature. You can configure the time periods between the detection of exceeded thresholds and the controller's commencing an automatic shutdown.

The shutdown does not electrically disconnect the subsystem. When shutdown is commenced, the subsystem stops responding to I/O requests and flushes all cached writes in its memory. During that time, system administrators should have been notified of the

condition and have begun restoring proper cooling of the subsystem. Extended operation under critical conditions like elevated temperature greatly reduces system efficiency and will eventually cause component failure.







Step 1. Select "View and Edit Peripheral Devices" on the Main Menu and press [ENTER].



Choose "Set Peripheral Device Entry" and "Event Trigger Option" by pressing [ENTER]. The auto-shutdown options display.



Move your cursor bar to "Temperature exceeds threshold." Press [ENTER] and select a configurable time span between the detection of exceeded temperature and the controller's commencing an automatic shutdown.

7-4 RAID, Inc.

7.1.3 **Voltage and Temperature Self-monitoring**

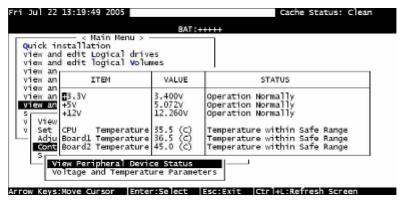
Follow the steps below to check voltage and temperature readings:



Enter the Main Menu and select "View and Edit Peripheral Devices."



Use the arrow keys to scroll down and select "Controller Peripheral Device Configuration," "View Peripheral Device Status," and then press [ENTER].





JStep 3. The controller voltage and temperature readings display.



The enclosure fan status and the temperature readings from chassis sensors are shown in 7.3 Enclosure Devices Status (Peripheral Device Status.

7.1.3.1 **Changing Monitoring Thresholds**



Open your PC Terminal Emulation utility. Enter the Main Menu and select "View and Edit Peripheral Devices."



Use the arrow keys to scroll down and select "Controller Peripheral Device Configuration," "Voltage and Temperature Parameters," confirm by pressing [ENTER].



CAUTION!

It is not recommended to change the threshold values unless you need to coordinate the RAID controller's values with that of your ODM RAID enclosure. If a value exceeding the safety range is entered, an error message will prompt and the new parameter will be ignored.

For example, if the controller operates in a system enclosure where the upper limit on ambient temperature is relatively high or low, adjusting the default thresholds can coordinate the controller status monitoring with that of the ODM enclosure.

```
Quick installation

Quick installation

Quick installation

view and edit Logical drives
view and edit Host luns
view and edit Scsi channels
view and edit Scsi channels
view and edit Scsi channels
view and edit Configuration parameters

View and edit Peripheral devices

View and edit Peripheral devices

View Trigger Thresholds for +3.3V Events

Adju Trigger Thresholds for +12V Events

Adju Trigger Thresholds for Peripherature Events

Trigger Thresholds for CPU Temperature Events

Trigger Thresholds for Board Temperature Events

Arrow Keys:Move Cursor Enter:Select Esc:Exit Ctrl+L:Refresh Screen
```



Step 4. Scroll down and select an item to configure.

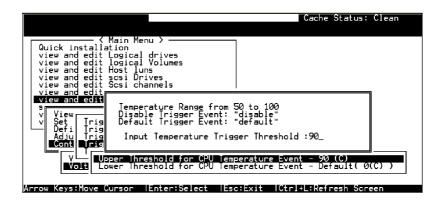




Step 5.

Select an item, such as "Trigger Thresholds for CPU Temperature Events." Press [ENTER] and a list of selections will appear. You can change the upper or lower threshold values by keying a number. Press [ENTER] to confirm.

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A configuration window will prompt. Enter any value within the safety range. Values exceeding the safety range will be rejected by controller firmware.





Follow the same method to modify other threshold parameters.

7.2 UPS Support

UPS status monitoring is available from firmware release 3.34 onward. This feature enables the RAID subsystem to observe and respond to the status of the UPS (battery charge or AC power) by dynamically switching the write policy.

Requirements for UPS Status Monitoring:

- 1. Connect the serial port on a UPS device to the controller/subsystem's COM2 serial port.
- 2. Set the same Baud Rate to the system COM2 and the UPS serial port. Please refer to *RAID Planning Guide*, RS-232C Serial Port Settings.
- 3. Set the UPS option as described in 7.1.1.1 to "Enabled."

Condition Reports and Reactions:

 When mains power is lost or when the UPS charge is low, an event is issued. The subsystem will commence an auto cacheflush and will be forced to adopt the conservative caching mode, the "write-through" mode.

- 2. When the serial port connection is lost or when the UPS is disconnected, an event is issued to notify system managers that the external UPS is absent.
- 3. When the UPS battery charge or mains power is restored to a safe functioning level, the subsystem automatically restores the original write policy.

7.3 Enclosure Devices Status (Peripheral Device Status)

To check the operational statuses of enclosure devices, follow the steps below:



Step 1

Select "View and edit Peripheral Devices" on the Main Menu and press [ENTER].



Step 2.

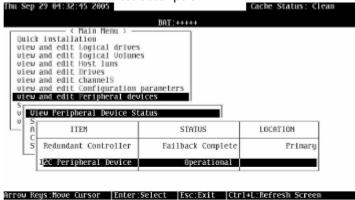
Choose "View Peripheral Device Status," then press [ENTER] again. The device list displays.



Step 3.

Press [ENTER] on the "I2C Peripheral Device" to display a list of peripheral devices (enclosure modules). Monitoring of device status depends on enclosure implementation and is accessed through different interfaces, e.g., SAF-TE, S.E.S., or I2C serial bus. Enclosure devices usually include the following:

- 1. Drive failure output definition
- 2. Cooling FAN
- 3. Power supply
- 4. Temperature Sensors
- 5. Device set description



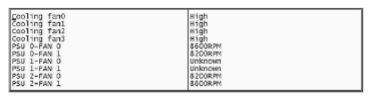
7-8 RAID, Inc.

Below is a screen showing the enclosure devices linked through an I²C serial bus:



Step 4. Press [ENTER] on a component type to examine its operating status.

Following is a screen listing all cooling fans in a 3U enclosure, including those embedded in power supply modules.



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8

Data Integrity

This chapter discusses various firmware mechanisms that help to ensure data integrity.

No system is completely safe from hardware faults. For example, although the chance of occurrence is considerably low, the occurrences of bad blocks on two (RAID 5) or three (RAID 6) hard drives can fail a whole data set. When properly configured, the functions below help to minimize the chance of data loss:

- 1. Event Triggered Operations (refer to Chapter 10)
- 2. Failed Drive Detection
- 3. Scheduled Maintenance
- 4. Regenerate Logical Drive Parity
- 5. Rebuild Priority
- 6. Verification on Writes



NOTF:

- 1. Some of the configuration options may not be available to all subrevisions of firmware.
- 2. All figures in this chapter are showing examples using the management hyper terminal screen.

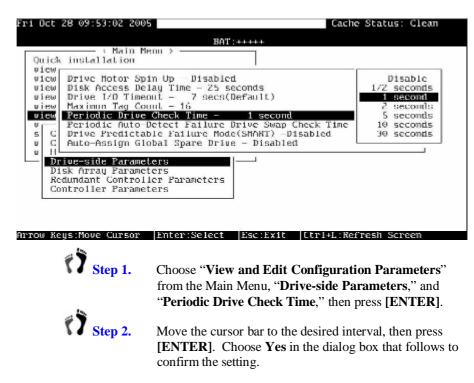
Data Integrity 8-1

8.1 Failed Drive Detection

8.1.1 Periodic Drive Check Time

The "Periodic Drive Check Time" is the time interval for the controller to check all disk drives that were on the drive bus at system startup (a list of all the drives that were detected can be seen under "View and Edit Drives").

The default value is "Disabled." If set to "1 second," it means that if a drive is removed from the bus, the subsystem will poll the drive bus every second and be able to know if a drive is removed – so long as no host accesses that drive. Changing the check time to any other value allows the controller to check – at the selected time interval – all of the drives that are listed under "View and Edit Drives." If any drive is then removed, the controller will be able to know – even if no host accesses that drive.



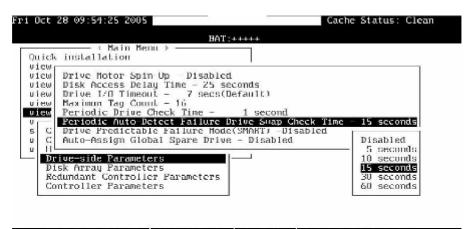
8.1.2 Periodic Auto-Detect Failure Drive Swap Check Time

The "Drive-Swap Check Time" is the interval at which the controller checks to see if a failed drive has been swapped. When a logical drive's member drive fails, the controller will continuously scan the drive bus (at the selected time interval). Once the failed

8-2 RAID, Inc.

drive has been swapped with a drive that has the adequate capacity to rebuild the logical drive, the rebuild will begin automatically.

The default setting is "Disabled," meaning that the controller will not automatically acknowledge if a failed drive has been replaced. To enable this feature, select a time interval.



RegistMove Cursor | EntertSelect | Esc:Exit | Ctrl+L:Refresh Screen



Choose "Periodic Auto-Detect Failure Drive Swap Check Time" from the "Drive-side Parameters" list, and press [ENTER].



Move your cursor bar to the desired interval; then press [ENTER]. Choose Yes in the dialog box that follows to confirm the setting.

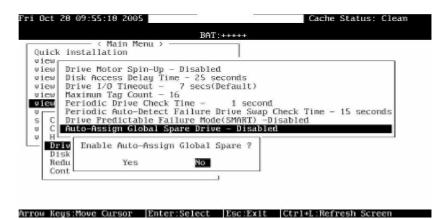


IMPORTANT!

- f The "Periodic Drive Check Time" is enabled by choosing a time value. The RAID controller will poll all connected drives through the controller's drive channels at the assigned interval. Drive removal will be detected even if a host does not attempt to access data on that specific drive.
- f If the "Periodic Drive Check Time" is set to "Disabled" (the default setting is "Disabled"), the controller will not be able to detect any drive removal that occurs after the controller initialization process. The controller will only be able to detect drive removal when host access is directed to the drive side.

Data Integrity 8-3

8.1.3 Auto-Assign Global Spare Drive



The "Auto-Assign" function automatically assigns any "new" drives that are not included in logical configurations as Global Spares.

The Fault Scenario:

Spare drives accelerate rebuild of a logical drive. In the example described below, multiple faults can occur at the same time making the array exposed to the risk of data loss:

- Š There is only one Global Spare in a RAID subsystem.
- Š That Global Spare has been used to rebuild a logical drive.
- Š The failed drive is swapped out and replaced by a new one.
- Š Chances are system administrators forgot to configure the replacement drive as a spare.
- Š A member of another logical drive fails.
- S The subsystem has no spare left. Performance decreases for a considerable portion of system resources has to be conducted to generate data from the remaining members of the logical drive. If yet another member fails in the logical drive, data is lost.

The chance of failing two drives increases when a failed drive in the array cannot be replaced immediately for the lack of spare drives.

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The Function:

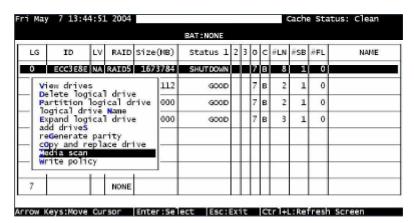
If a drive has a capacity smaller or apparently larger than the members of configured arrays, the controller may avoid using it as a global spare.

Enable the function and reset the controller for the configuration to take effect.

8.2 Scheduled Maintenance

Task Scheduler

The Task Scheduler functionality allows Media Scans to be scheduled beginning at a specified start time and repeating at regular intervals defined by a configurable interval period. Each such schedule can be defined to operate on individual hard drives, all drives of a certain class, all member drives of a specified logical drive, or all member drives of all logical drives. UIs supported are RS232C terminal menus and RAIDWatch GUI manager.



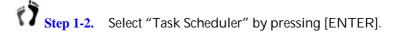
Step 1. Accessing the Task Scheduler Utility

Step 1-1.

The scheduler utility can be accessed through the "View and Edit Logical Drives" menu by selecting a configured array and to display the list of array-related functions. Select "Media Scan" by pressing [ENTER].

Media Scan Priority - Normal Iteration Count - Single Time Task Scheduler

Data Integrity 8-5



Step 2. Creating a New Schedule



Step 2-1. If there is no preset schedule, a confirm box will prompt.

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ity - Normal		2	7 В	2	1	Ţ
- Single Time		7	7 В	2	1	
	- Single Time Task Schedule - /					Task Schedule - Add a New Task Schedule

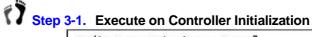
	can Priority - Normal on Count - Single Time	7	B 2	2 1	0
Idx	Start Time and Date	Period		Exec	on Init
0	Fri May 7 14:09:00 2004	10 hours		Prior	ity
	iew Schedule Information	1111	T	1 1	



Step 2-2. Press [ENTER] on an existing schedule to display the configuration options. You may choose to check information of a task schedule, to create a new schedule, or to remove a configured schedule.

Step 3. Task Scheduler Options

To configure a task schedule, browse through the following options and make necessary changes:



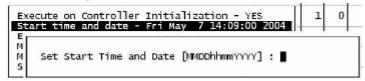


Execute on Controller Initialization - YES
Start time and date - Not Set
Execution Period - Not Set
Media Scan Mode - Concurrence
Media Scan Priority - Normal
Select logical drives

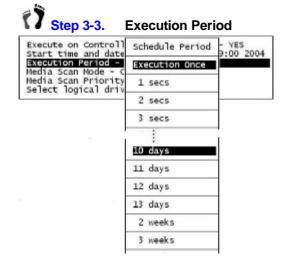
This option determines whether Media Scan is automatically conducted whenever the RAID system is reset or powered on.

8-6 RAID, Inc.





Enter time and date in its numeric representatives in the following order: month, day, hour, minute, and the year.

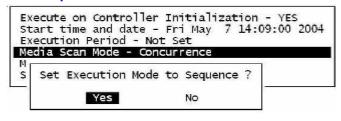


The scheduler memorizes the date and the time the actions are to be executed. Select one of the following:

- f If the action is intended to be executed for one time only, select "Execution Once."
- f In the case of a periodic action, the action is executed at the specified "start time," and then re-enacted at the time interval indicated in the execution period so as to be executed again later. The selectable interval ranges from one second to several weeks.

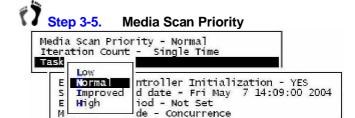


Step 3-4. Media Scan Mode



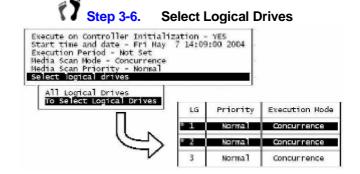
Data Integrity 8-7

If the maintenance schedule includes more than one logical drive, the scan can be performed simultaneously on multiple logical drives together or separately on one logical drive at a time following a sequential order.



Media Scan Priority - Normal Select logical drives

The scan priority determines how much of the system's resources will be consumed to perform the scheduled task. Select "Low" for better array performance and longer time to complete the media scan. Higher priority allows higher scan performance at the cost of reduced array performance.

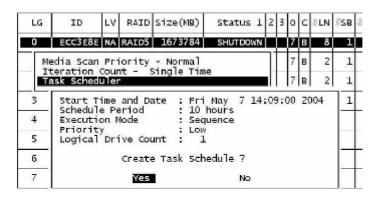


Press [ENTER] on "Select Logical Drives" to bring out a sub-menu. From there you may include all configured arrays or press [ENTER] on "To Select Logical Drives" to select one or more specific logical drive(s).

Logical drives can be tagged for inclusion by positioning the cursor bar on the logical drive and then pressing [ENTER]. An asterisk (*) mark will appear on the selected physical drive(s). To deselect the drive, press [ENTER] again on the selected drive. The "*" mark will disappear. Use the same method to select more logical drives if preferred.

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Step 4. Confirming the Creation of a Task Schedule



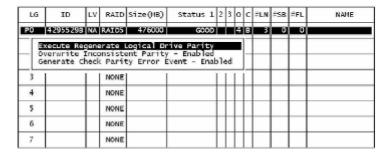
Step 4-1.

When finished with setting the scheduler options, press [ESC] to display a confirm box.

Step 4-2.

Verify all information in the box before choosing "Yes" to confirm and to complete the configuration process.

8.3 Regenerating Logical Drive Parity



Parity regeneration is a function manually performed onto RAID-1/3/5/6 arrays to determine whether inconsistency has occurred with data parity.

You may perform the parity check directly without changing the two options below, or set preferred options and then press [ENTER] on "Execute Regenerate Logical Drive Parity" to begin the operation.

Data Integrity 8-9

8.3.1 Overwrite Inconsistent Parity

Default is "enabled."

If an array's data parity is seriously damaged, restoring parity data by regenerating and overwriting the original data may cause data loss. Disable this option if you suspect parity data has been seriously corrupted.

8.3. 2 Generate Check Parity Error Event

Default is "enabled."

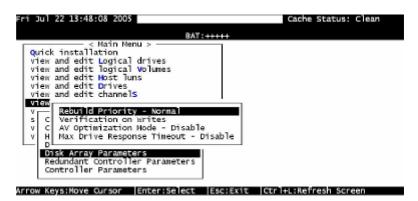
When enabled, parity inconsistency will be reported as system events.



IMPORTANT!

If a regenerating process is stopped by a drive failure, the process cannot be restarted until the logical drive is successfully rebuilt by having its failed member replaced.

8.4 Disk Array Parameters





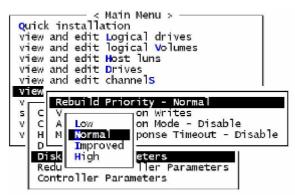
Select "View and Edit Configuration Parameters" on the Main Menu and press [ENTER].



Choose "Disk Array Parameters," then press [ENTER] again. The Disk Array Parameters menu will appear.

8-10 RAID, Inc.

8.4.1 Rebuild Priority



- Step 1.
- Choose "Rebuild Priority," then press [ENTER]. A list of the priority selections (Low, Normal, Improved, or High) displays.
- Step 2.

Move the cursor bar to a selection, then press [ENTER].

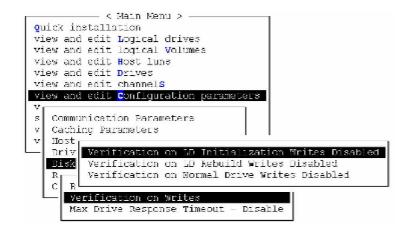
8.4.2 Verification on Writes

Errors may occur when a hard drive writes data. To avoid the write error, the controller can force hard drives to verify written data. There are three selectable methods:

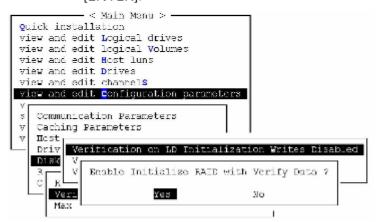
- f Verification on LD Initialization Writes
 Performs Verify-after-Write when initializing a logical drive
- f Verification on LD Rebuild Writes
 Performs Verify-after-Write during the rebuild process
- f Verification on LD Normal Drive Writes Performs Verify-after-Write during normal I/Os

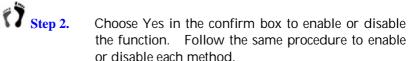
Each method can be enabled or disabled individually. Hard drives will perform Verify-after-Write according to the selected method.

Data Integrity 8-11



Move the cursor bar to the desired item, then press [ENTER].







IMPORTANT!

The "verification on Normal Drive Writes" method will affect the "write" performance of your RAID system.

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9

Array Expansion

The array expansion functions allow you to expand storage capacity without the cost of buying new equipment. Expansion can be completed on-line while the system is serving host I/Os.

9.1 Overview

What is RAID Expansion and how does it work?

Before the invention of RAID Expansion, increasing the capacity of a RAID system meant backing up all data in the disk array, recreating the disk array configuration with new drives, and then restoring data back into system.

RAID, Inc.'s RAID Expansion technology allows users to expand a logical drive by adding new drives, or replacing drive members with drives of larger capacity. Replacing is done by copying data from the original members onto larger drives; the smaller drives can then be replaced without powering down the system.

9.2 Notes on Expansion

1. Added Capacity:

When a new drive is added to an existing logical drive, the capacity brought by the new drive appears as a new partition. For example, if you have 4 physical drives (36GB each) in a logical drive, and each drive's maximum capacity is used, the capacity of the logical drive will be 108GB. (One drive's capacity is used for parity, e.g., RAID 3). When a new 36GB drive is added, the capacity will be increased to 144GB in two separate partitions (one is 108GB and the other 36GB).

2. Size of the New Drive:

A drive used for adding capacity should have the same or more capacity as other drives in the array.

3. Applicable Arrays:

Expansion can only be performed on RAID 0, 1, 3, 5, and 6 logical drives. Expansion cannot be performed on logical configurations that do not have parity, e.g., NRAID or RAID 1.



NOTE:

Expansion on RAID0 is not recommended, because the RAID0 array has no redundancy. Interruptions during the expansion process may cause unrecoverable data loss.

4. Interruption to the Process:

Expansion should not be canceled or interrupted once begun. A manual restart should be conducted after the occurrence of a power failure or interruption of any kind.

Expand Logical Drive: Re-striping

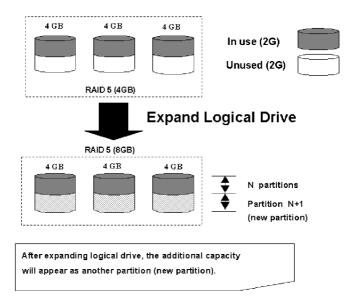


Figure 9 - 1: Logical Drive Expansion

RAID levels supported: RAID 0, 1, 3, 5 and 6 Expansion can be performed on logical drives or logical volumes under the following conditions:

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- There is unused capacity in a logical unit
- 2. Capacity is increased by using member drives of larger capacity (see Copy and Replace in the discussion below)

Data is recalculated and distributed to drive members or members of a logical volume. Upon the completion of the process, the added or the previously unused capacity will become a new partition. The new partition must be made available through host LUN mapping in order for a host adapter to recognize its presence.

9.3 Mode 1 Expansion:

Adding Drives to a Logical Drive

Use drives with the same capacity as the original drive members. Once completed, the added capacity will appear as another partition (new partition). Data is automatically re-striped across the new and old members during the add-drive process. See the diagram below to get a clear idea:

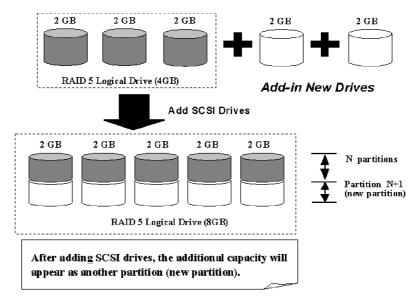


Figure 9 - 2: Expansion by Adding Drive

RAID levels supported: RAID 0, 1, 3, 5, and 6.

The new partition must be made available through a host ID/LUN.

Add Drive Procedure



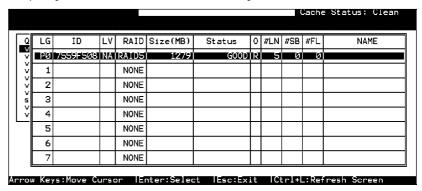
Step 1.

First select from the Main Menu, "View and Edit Logical Drive," and select a logical drive to add a new drive to.



NOTE:

The drive selected for adding should have a capacity no less than the original member drives. If possible, use drives of the same capacity because all drives in the array are treated as though they have the capacity of the smallest member in the array.





Step 2.

Press [ENTER] to select a logical drive and choose "Add Drives" from the submenu. Proceed with confirming the selection.

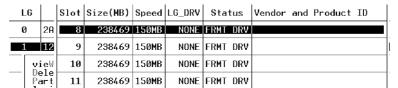
LG	ID	LV	RAID	Size	(MB)	Status	1	2	35	Ò	Ç	#LN	#SB	#FL	NAME
0	50080200	0	RAID6		1000	GO	90			Z	3	4	0	0	
Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parents Parent	ew drive elete log artition ogical dr cpand log ggrate lo de artice opy and r edia scan ite poli	rical logi ive rical gica gica epla		ive											



Step 3

Available drives will be listed. Select one or more drive(s) to add to the target logical drive by pressing [ENTER]. The selected drive will be indicated by an asterisk "*" mark.

9-4 RAID, Inc.



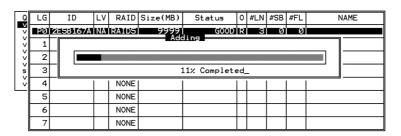


Step 4. Press [ESC] to proceed and the notification will prompt.

9	LG	ID	LV	RAID	Size(MB)	Status	0	MLN	#SB	#FL	NAME	
		(ANSARALIAN)	N/A	33000	9999	G000) isi	3	9	8		
šE.	Ė	•			200	ding Notificatio	ñ					
Ŭ٦	1	LG: 6	210	gical	Drive NO	TICE: Start	100	m Andr	4 De i	um C	Decat Lon	
110		Sec. 50 . 1		Bronz	MI ATE IN	ITAC: OFDIE	411	a west				
š E	Ļ			grous	01210 110	TIVE: OTHER	A11	9 ////	,			
	4			NONE			1	y //\.				_
3	4		H				-	- A				_
3	4 5 6			NONE				9 700			,	_

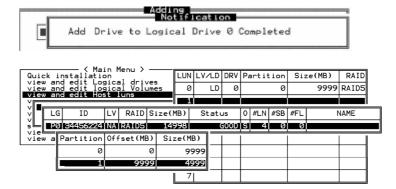


Step 5. Press [ESC] again to cancel the notification prompt; a status bar will indicate the percentage of progress.





Step 6. Upon completion, there will appear a confirming notification. The capacity of the added drive will appear as an unused partition.



The added capacity will be automatically included, meaning that you do not have to "expand logical drive" later. Map the added capacity to another host ID/LUN to make use of it.

As diagrammed above, in "View and Edit Host LUN," the original capacity is 9999MB, its host LUN mapping remains unchanged, and the added capacity appears as the second partition.



IMPORTANT!

- f Expansion by adding drives can not be canceled once started. If power failure occurs, the expansion will be paused and the controller will NOT restart the expansion when power comes back on. Resumption of the RAID expansion must be performed manually.
 - f If a member drive of the logical drive fails during RAID expansion, the expansion will be paused. The expansion will resume after the logical drive rebuild is completed.

9.4 Mode 2 Expansion:

Copy and Replace Drives with Drives of Larger Capacity

You may also expand your logical drives by copying and replacing all member drives with drives of higher capacity. Please refer to the diagram below for a better understanding. The existing data in the array is copied onto the new drives, and then the original members can be removed.

When all the member drives have been replaced, execute the "Expand Logical Drives" function to make use of the added capacity.

9-6 RAID, Inc.

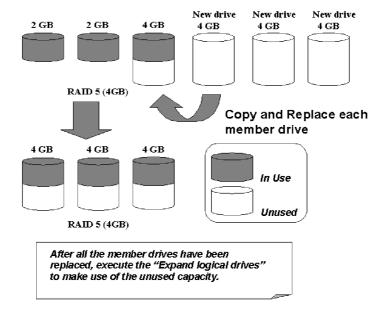


Figure 9 - 3: Expansion by Copy & Replace

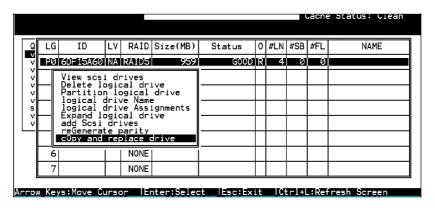
RAID levels supported: RAID 0, 1, 3, 5 and 6

Copy and Replace Procedure



Step 1.

Select from Main Menu "View and Edit Logical Drives." Select a target array, press [ENTER] and scroll down to choose "Copy and Replace Drive." Press [ENTER] to proceed.





Step 2.

The array members will be listed. Select the member drive (the source drive) you want to replace with a larger one.

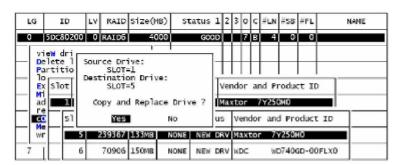
LG		Slot	Size(MB)	Speed	LG_DRV	Status	Vendor and Product ID	
0	28	8	238469	150MB	NONE	FRMT DRV		
1	12	9	238469	150MB	NONE	FRMT DRV		i
	ie₩	10	238469	150MB	NONE	FRMT DRV		
	ele art	11	238469	150MB	NONE	FRMT DRV		



Step 3. Select one of the members as the "source drive" (status indicated as ON-LINE) by pressing [ENTER]; a table of available drives will prompt.

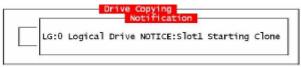


Select a "new drive" to copy the capacity of the source drive onto. The channel number and ID number of both the "Source Drive" and the "Destination Drive" will be indicated in the confirm box.



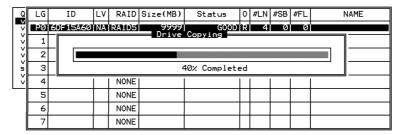


Step 5. Choose Yes to confirm and proceed.





Step 6. Press [ESC] to view the progress.

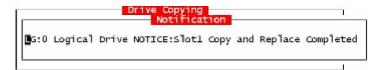




ep 7. Completion of the Copy and Replace process will be indicated by a notification message. Follow the same method to copy and replace every member drive. You may now perform "Expand Logical"

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Drive" to make use of the added capacity, and then map the additional capacity to a host LUN.



9.5 Making Use of the Added Capacity: Expand Logical Drive

In the following example, the logical drive is originally composed of three member drives and each member drive has the capacity of 1GB. "Copy and Replace" has been performed on the logical drive and each of its member drives has been replaced by a new drive with the capacity of 2GB. The next step is to perform "Expand Logical Drive" to utilize the additional capacity brought by the new drives.



Step 1

Select "View and Edit Logical Drives" from the Main Menu and select the logical drive with its members copied and replaced.



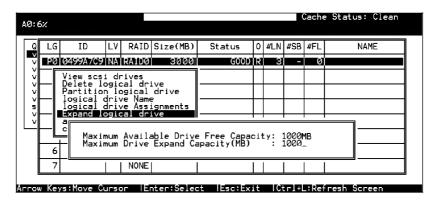
Step 2.

Select "Expand Logical Drive" in the sub-menu and press [ENTER] to proceed. A confirming box will appear.



Step3.

Proceed by pressing [ENTER] or entering any value no larger than the "maximum drive expand capacity" and press [ENTER].





Step 4. Choose Yes to confirm.

Q	LG	ID	L۷	RAID	Size(MB)	Status	0	#LN	#SB	#FL	NAME
V	PØ	0499A7C9	NΑ	RAIDØ	3000	GOOD	R	3	I	Ø	
l v		View scs:	i dı	rives							
l v		Delete lo Partition logical] [ogical	drive						
5		logical d	riv	ve Ass.	ignments						
Lv		a			Drive ?	1					
			33	_	No						
	6		±1	<u>'</u>	1						
	7			NONE							

7

Step 5. Upon completion, you will be prompted by the notification message.



Step 6. Press [ESC] to return to the previous menu screen. As shown below, the total capacity of logical drive has been expanded to 6GB.

Q		ID	L۷	RAID	Size(MB)	Status	0	#LN	#SB	#FL	NAME
Ÿ	P0	0499A7C9	NΑ	RAIDØ	6000	GOOD	R	3		Ø	
l ×	1			NONE							
l ×	2			NONE							
s	3			NONE							
*				NONE							
_	5			NONE							
	6			NONE							
	7			NONE							

9.6 Expand Logical Volume



NOTE:

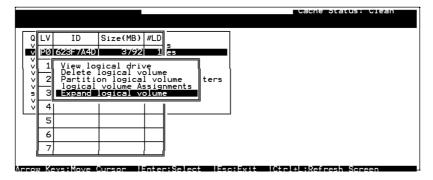
If the logical drive that has an expanded capacity is a member of a logical volume, make sure you expand all logical drives within the logical volume. A logical volume consists of logical drives that are "striped" together. Unless all logical drives within a logical volume has excessive capacity, you can expand a logical volume.



Step 1.

To expand a logical volume, expand its logical drive member(s) and then perform "Expand logical volume."

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Step 2.

When prompted by "Expand Logical Volume?", choose Yes to confirm and the process will be completed immediately.

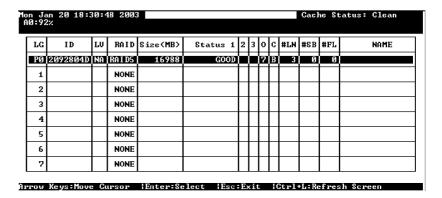
9.7 Configuration Example: Volume Extension in Windows 2000[®]

Limitations When Using Windows 2000

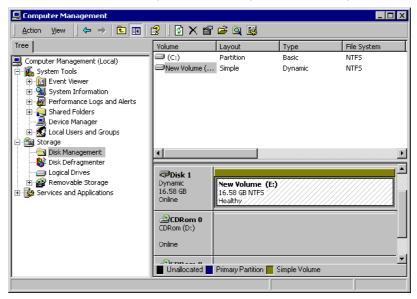
- These limitations apply only to the Windows NT Server or Windows 2000 Server Disk Management which includes the Extend Volume Set function; Windows NT Workstation does not support this feature. The Volume Set Expansion formats the new area without affecting files existing on the original volume.
- 2. The system drive (boot drive) of a Windows NT/2000 system cannot be expanded.
- 3. The drive to be expanded should be using the NTFS file system.

Example

The following example demonstrates the expansion of a 16988MB RAID 5 logical drive. The HyperTerminal emulation software that comes with Windows Server is used to connect to the RAID controller via RS-232C.

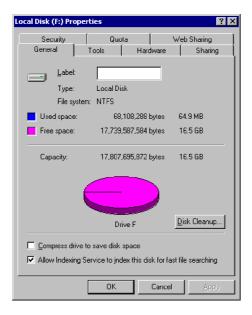


You can view information about this drive in the Windows 2000 Server's Computer Management -> Storage -> Disk Management.

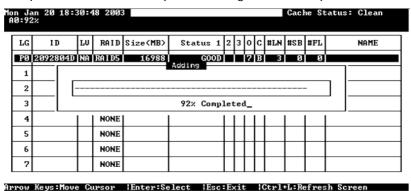


Place the cursor on Disk 1, right-click your mouse, and select "Properties." You will see that the total capacity for the Drive E: is about 16.5GB.

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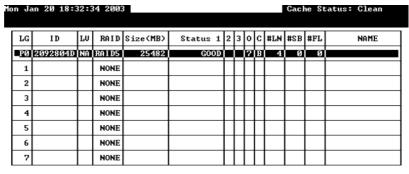


Follow the steps described in the previous section to "add" or "copy & replace" disk drives and perform "Logical Drive Expansion."



The 16 FCP legical drive has become a 2FCP legical drive. Place th

The 16.5GB logical drive has become a 25GB logical drive. Place the cursor on that logical drive, and then press [ENTER].



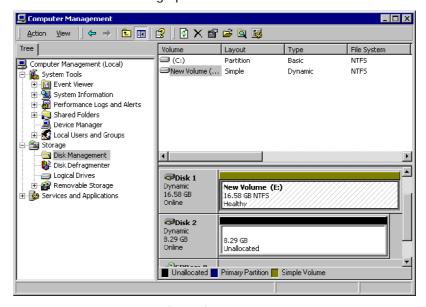
Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

From the menu, select "Partition Logical Drive." You will see that the 25GB logical drive is composed of a 17GB partition and an 8.4GB partition.

1on J	an 20 18:3	33:3	39 2003					Cache Stati	ıs: Clean
LG	ID	LU	RAID	Size(MB)	Γ	Partition	Offset(MB)	Size(MB)	NAME
PØ	2092804D	NΑ	RA I DS	25482		0	0	16988	
1			NONE		Γ	1	16988	8494	
2			NONE		Γ	2			
3			NONE		Γ	3			
4			NONE		Γ	4			
5		Г	NONE		Γ	5			
6			NONE		Γ	6			
7			NONE		Г	7			

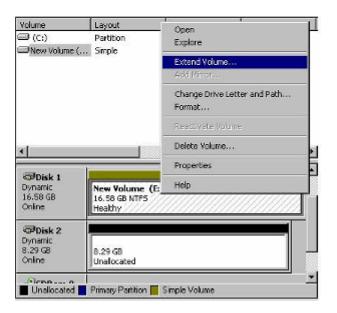
Follow the directions in *Chapter 5* and *Chapter 7* to map the new partition to a host LUN. The new partition must be "mapped" to a host LUN in order for the HBA (host-bus adapter) to see it. Once you have mapped the partition, reboot your Windows server. The HBA should be able to detect an additional disk during the initialization process.

Return to Windows 2000 Server's Disk Management. There now exists a Disk 2 with 8.3GB of free space. You may use the "rescan disks" command to bring up the new drive.

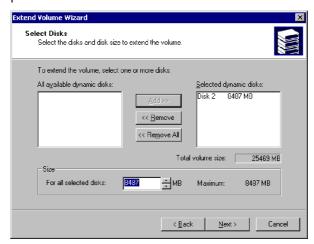


Select an existing volume (Disk1) and then right-click on the disk column. Select "Extend Volume" to proceed.

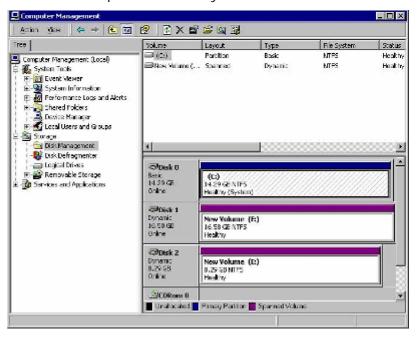
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The Extend Volume Wizard will guide you through the rest of the process.



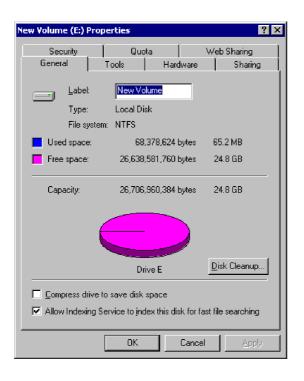
The screen will display that the volume set of Drive E: has been extended into a spanned volume by the 8.3GB in Disk2.



Logical Drive E: is now composed of two partitions with a total volume of 2500MB. To see this, hold down on the <Ctrl> key and select both Disk 1 and Disk2; then right-click your mouse and select "Properties."

Drive E: now has a capacity of about 25GB.

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10

S.M.A.R.T. Configuration

10.1 Overview

S.M.A.R.T.

With the maturity of technologies like S.M.A.R.T., drive failures can be predicted to certain degree. Before S.M.A.R.T., receiving notifications of drive bad block reassignments may be the most common omen that a drive is about to fail. In addition to the S.M.A.R.T.-related functions as will be discussed later, a system administrator can also choose to manually perform "Clone Failing Drive" on a drive which is about to fail.

This function provides system administrators a choice on when and how to preserve data from a failing drive. Although not necessary under normal conditions, you may also replace any drive at-will even when the source drive is healthy.

The "Clone Failing Drive" can be performed under the following conditions:

- **1.** Replacing a failing drive either detected by S.M.A.R.T. or notified by the controller.
- **2.** Manually replacing and cloning any drive with a new drive.

10.2 Clone Failing Drive

Unlike the similar functions combined with S.M.A.R.T., the "Clone Failing Drive" is a manual function. There are two options for cloning a failing drive: "Replace after Clone" and "Perpetual Clone."

10.2.1 Replace after Clone

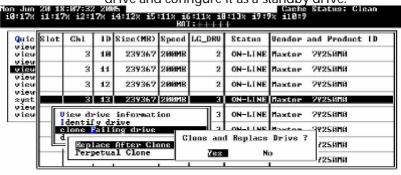
Data on the source drive, the drive with predicted errors (or any selected member drive), will be cloned to a standby spare and replaced later by the spare. The status of the replaced drive, the original member drive with predicted errors, will be redefined as a "used drive." System administrators may replace the "used drive" with a new one, and then configure the new drive as a spare drive.



Locate the logical drive to which the drive with predictable errors belongs. Select the "Clone Failing Drive" function.



Select "Replace After Clone." The controller will automatically start the cloning process using the existing "stand-by" (dedicated/global spare drive) to clone the source drive (the target member drive with predicted errors). If there is no standby drive (local/global spare drive), you need to add a new drive and configure it as a standby drive.





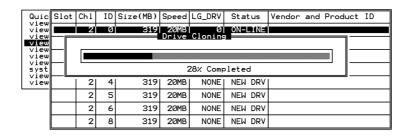
The cloning process will begin with a notification message. Press [ESC] to proceed.





Step 4. The cloning process will be indicated by a status bar.

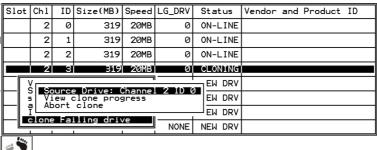
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Step 5.

You may quit the status bar by pressing [ESC] to return to the table of the connected drives. Select the drive indicated as "CLONING" by pressing [ENTER].



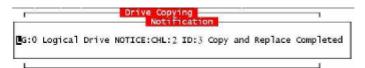


Select "Clone Failing Drive" again to view the current status. You may identify the source drive and choose to "View Clone Progress," or "Abort Clone" if you happen to have selected the wrong drive.



Step 7.

When the process is completed, you will be notified by the following message.

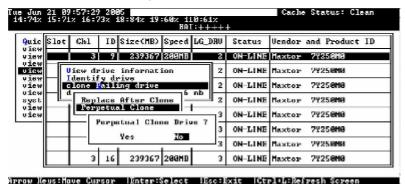


10.2.2 Perpetual Clone

The standby spare will clone the source drive, the member drive with predicted errors or any selected drive, without substituting it. The status of the spare drive will be displayed as "clone drive" after the cloning process. The source drive will remain a member of the logical drive. If the source drive fails, the clone drive can readily take its place in the array.



In "View and Edit Drives," locate the member drive that shows predicted errors. Select "Clone Failing Drive," and choose "Perpetual Clone."



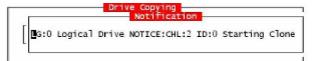


Step 2.

The controller will automatically start the cloning process using the existing "stand-by" (local/global spare drive) to clone the source drive (the target member drive).

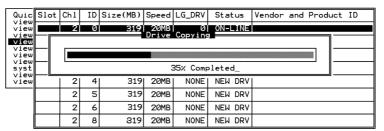


Step 3. The cloning process will begin with a notification message:





Step 4. Press [ESC] to view the current progress:





Step 5.

You may quit viewing the status bar by pressing [ESC] to return to the previous menu. Select the drive indicated as "CLONING" by pressing [ENTER]. Select "Clone Failing Drive" again to view the progress. You may identify the source drive and choose to "View Clone Progress" or "Abort Clone" if you happen to have selected the wrong drive.

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Quic	Slot	Ch1	ID	Size(MB)	Speed	LG_DRV	Status	Vendor	and	Product	ID
view		2	0	319	20MB	0	ON-LINE				
view view		2	1	319	20MB	Ø	ON-LINE				
view view		2	2	319	20MB	0	ON-LINE				
view syst		2	3	319	20MB	0	CLONE				
view view	l I '	/ S E S7		e Drive: (EW DRV				
		s Re	eplad	ce origina clone	al with	clone	EW DRV				
		ī 🗀		ling driv	, a		□EW DRV				
		-710IN			/e	NONE	NEW DRV				



Step 6

The cloning progress will be completed by a notification message as displayed below:





Step 7.

You may press [ESC] to clear the notification message to see the drives' status after the cloning process. The source drive (Channel 1 ID 5) remains as a member of logical drive "0," and the "stand-by" drive (Channel 1 ID 2, the dedicated/global spare drive) has become a "CLONE" drive.

						,					
	Slot	Chl	ID	Size(MB)	Speed	LG_DRV	Status	Vendor	and	Product	ID
view view		2	0	319	20MB	0	ON-LINE				
view View		2	1	319	20MB	0	ON-LINE				
view view		2	2	319	20MB	Ø	ON-LINE				
view syst		2	3	319	20MB	0	CLONE				
view view		2	4	319	20MB	NONE	NEW DRV				
		2	5	319	20MB	NONE	NEW DRV				
i		2	6	319	20MB	NONE	NEW DRV				
		2	8	319	20MB	NONE	NEW DRV				

10.3 S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology)

This section provides a brief introduction to S.M.A.R.T. as one way to predict drive failure and RAID, Inc.'s implementations with S.M.A.R.T. for preventing data loss caused by drive failure.

A. Introduction

Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) is an emerging technology that provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined disk drives attributes that are susceptible to degradation over time.

If a failure is likely to occur, S.M.A.R.T. makes a status report available so that the host can prompt the user to backup data from the failing drive. However, not all failures can be predicted. S.M.A.R.T. predictions are limited to the attributes the drive can monitor which are selected by the device manufacturer based on the attribute's ability to contribute to predict degrading or fault conditions.

Although attributes are drive specific, a variety of typical characteristics can be identified:

- f Head flying height
- f Data throughput performance
- f Spin-up time
- f Re-allocated sector count
- f Seek error rate
- f Seek time performance
- f Spin try recount
- f Drive calibration retry count

Drives with reliability prediction capability only indicate whether the drive is "good" or "failing." In a SCSI environment, the failure decision occurs on the disk drive and the host notifies the user for action. The SCSI specification provides a sense bit to be flagged if the disk drive determines that a reliability issue exists. The system then alerts the user/system administrator.

B. RAID, Inc.'s Implementations with S.M.A.R.T.

RAID, Inc. uses the ANSI-SCSI Informational Exception Control (IEC) document X3T10/94-190 standard.

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There are four selections related to the S.M.A.R.T. functions in firmware:

Disabled

Disables S.M.A.R.T.-related functions

Detect Only:

When the S.M.A.R.T. function is enabled, the controller will send a command to enable all drives' S.M.A.R.T. function, if a drive predicts a problem, the controller will report the problem in an event log.

Detect and Perpetual Clone

When the S.M.A.R.T. function is enabled, the controller will send a command to enable all drives' S.M.A.R.T. function. If a drive predicts a problem, the controller will report the problem in an event log. The controller will clone the drive if a Dedicated/Global spare is available. The drive with predicted errors will not be taken off-line, and the clone drive will still act as a standby drive.

If the drive with predicted errors fails, the clone drive will take over immediately. If the problematic drive is still working and another drive in the same logical drive fails, the clone drive will resume the role of a standby spare and start to rebuild the failed drive immediately. This prevents a fatal drive error if yet another drive should fail.

Detect and Clone + Replace

The controller will enable all drives' S.M.A.R.T. function. If a drive predicts a problem, the controller will report the problem in the form of an event log. The controller will then clone the problematic drive to a standby spare and take the problematic drive offline as soon as the cloning process is completed.



NOTE:

• If you are using drives of different brands in your RAID system, as long as they are ANSI-SCSI Informational Exception Control (IEC) document X3T10/94-190-compatible, there should not be any problems working with the controller/subsystem.

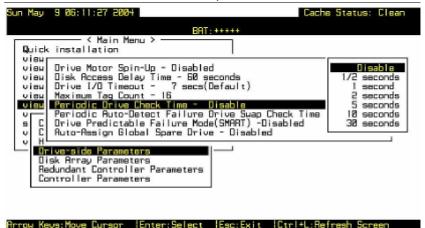
10.4 **Configuration Procedure**

10.4.1 **Enabling the S.M.A.R.T. Feature**

Follow the procedure below to enable S.M.A.R.T. on all drives.

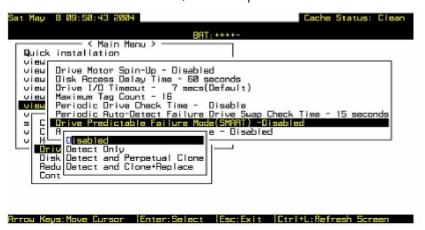


First, enable the "Periodic Drive Check Time" function. In \View and Edit Configuration Parameters\Drive-side Parameters\Periodic Drive Check Time, choose a time interval.





In **\View** and Edit Configuration Parameters\Drive Parameters\Drive-side Predictable Failure Mode <SMART>, choose one from "Detect Only," "Detect, Perpetual Clone" and "Detect, Clone+Replace."



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10.4.2 Examining Whether Your Drives Support S.M.A.R.T.

To see if your drive supports S.M.A.R.T., follow the steps below:

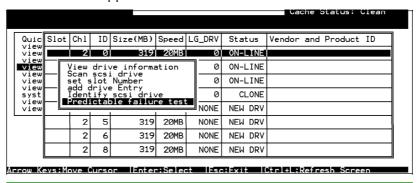


Step 1. Enable "S.M.A.R.T." for your drives in the RAID system.



Step 2.

In "View and Edit Drives," choose one drive to test to. Press [ENTER] on the drive; a sub-menu will appear.



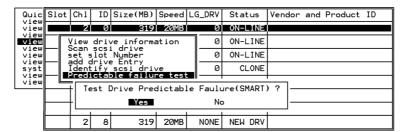


NOTE:

Note that a new item "Predictable Failure Test" appears in the submenu. If the S.M.A.R.T." feature is not properly enabled, this item will not appear in the sub-menu.



Step 3. Choose "Predictable Failure Test.," The controller will force the drive to simulate predictable drive errors.





Step 4.

Press [ENTER], and after a while (the next time the controller performs "Periodic Drive Check"), the controller will detect the errors simulated by the drive. An error message displays like this: "SMART-CH:? ID:? Predictable Failure Detected

(TEST)." If this error message appears, it means your drive supports S.M.A.R.T. features.

CHL:2 ID:0 SCSI Drive ALERT: Unexpected Sense Received (526)

If the error message does not appear, you may simply refer to related documentation or contact your drive manufacturer for information about whether the drive model and drive firmware version support S.M.A.R.T.

10.4.3 Using S.M.A.R.T. Functions



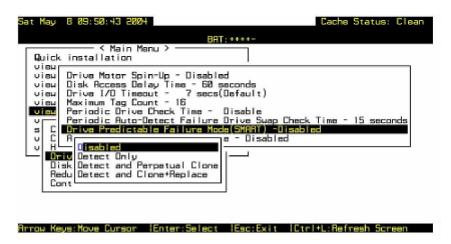
Step 1. Enable "S.M.A.R.T." on the RAID controller. Make sure your drives do support S.M.A.R.T. so that your system will work properly.



Step 2. Select a S.M.A.R.T.-related option

Step 2-1. The "Detect Only" Setting

Step 2-1-1. In \View and Edit Configuration
Parameters\Drive-side Parameters\Drive
Predictable Failure Mode <SMART>, choose
"Detect Only."



Whenever a drive detects symptoms of predictable drive failure, the controller will issue an error message.

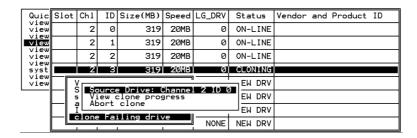
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Step 2-2. The "Detect, Perpetual Clone" Setting

Before selecting this option, you should make sure you have at least one spare drive for the logical drive (either Local Spare or Global Spare Drive).

Step 2-2-1. In \View and Edit Configuration
Parameters\Drive-side Parameters\Drive
Predictable Failure Mode <SMART>, choose
"Detect, Perpetual Clone."

Step 2-2-2. When a drive (logical drive member) detects predictable drive errors, the controller will "clone" the drive with a spare drive. You may enter the "View and Edit Drives" menu and click on the spare drive (either Local or Global one). Choose from the menu items if you want to know the status of the source drive, the cloning progress, or to abort cloning.





NOTE:

- f As a precaution against the untimely failure of yet another drive, when configured as "perpetual clone," the spare drive will only stay mirrored to the source drive (the drive with signs of failure), but not replace it until the source drive actually fails.
- f While the spare drive is mirroring the source drive, any occurrence of drive failure (when there are no other spare drives) will force the spare drive to give up the mirrored data and resume its original role – it will become a spare drive again and start rebuilding the failed drive.

Step 2-3. The "Detect, Clone + Replace" Function

Before enabling this option, make sure you have at least one spare drive to the logical drive. (Either Local Spare Drive or Global Spare Drive) Step 2-3-1. In \View and Edit Configuration
Parameters\Drive-side Parameters\Drive
Predictable Failure Mode <SMART>, choose
"Detect, Clone+Replace."

When a drive (a logical drive member) detects the predictable drive failure, the controller will "clone" the drive with a spare drive. After the "clone" process is completed, it will replace the source drive immediately. The source drive will be identified as a "used drive."

Step 2-3-2. If you want to see the progress of cloning, press [ESC] to clear the notification message and see the status bar.

The source drive's status will be defined as a "used drive" and will be immediately replaced and pulled offline. This drive should be replaced with a new one as soon as possible.

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11

Implementations for AV Applications

This chapter introduces some new firmware functions for AV applications. More options will be available for AV applications with future firmware releases.



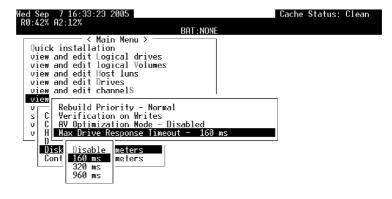
NOTE:

All exemplary screens are captured from a hyper terminal management console.

11.1 Maximum Drive Response Time

In situations such as drive failure or the occurrence of media error, a read or write action returned after several hundreds milliseconds would prove too long and cause choppy audio or dropped video frames.

The maximum response time option, as displayed below, provides a timeout value for processing read/write requests. If timeout is reported on a specific member of an array, the subsystem immediately retrieves data from the parity data and other members of the array. In this way, causes of delay can be eliminated.



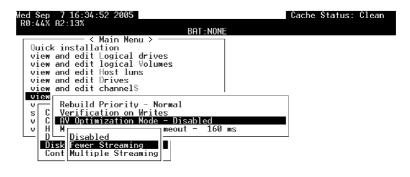
Arrow Kevs:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen

To prepare the array for read-intensive applications, the following are recommended:

- 1. Performance using the write-through caching mode is better than that using the write-back mode on subsystems equipped with redundant RAID controllers.
- 2. Arrays should not be partitioned.
- 3. The priorities for Rebuild or Add-drive operations should be set to "low."
- 4. Another timeout value, the "Drive I/O Timeout" which determines whether a drive has eventually failed to respond to I/O requests, is required as the first-level timeout.

AV Optimization Mode 11.2

The AV optimization is applied for the emerging Audio/Video streaming applications such as the VOD/MOD, NLE (Non-Linear Editing), and multi-streaming environments.



Arrow Keys:Move Cursor |Enter:Select |Esc:Exit |Ctrl+L:Refresh Screen

RAID, Inc. 11-2

Fewer Steams: (for applications featuring sequential I/Os and large block sizes; e.g., Video Editing)

The Maximum Drive Response Timeout will be automatically set to 160ms.

Multiple Steams: (for applications featuring smaller I/Os and more outstanding I/Os, e.g., Media Broadcasting)

The Maximum Drive Response Timeout will be automatically set to 960ms.



NOTE:

The Maximum Drive Response Timeout set here with the AV Optimization mode will over-rule any value set in the Drive Response Timeout specified in section 11.1.

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12

Redundant Controller

Sample topologies using redundant controllers can be found in the following discussions or in the *Installation and Hardware Reference Manual* that came with your RAID subsystems. The proceeding discussions will focus on the working theories and the configuration procedures for readying a redundant controller system.

Today's high-speed I/O interfaces pose increasing demands on signal quality. Depending on the enclosure design, signal paths for communications should have been strung between controllers over a common backplane. Your RAID subsystems, such as RAID, Inc.'s Falcon III / Magellan / X4 series, come with preset IDs and channel mode settings, and require no further configurations.

This chapter covers the following topics:

Sample Topologies

f 12.2.1 Requirements and Configuration Samples

Preparing Controllers

- f 12.2 Related Functions
 - o 12.2.1 Requirements
 - o 12.2.3 Limitations
 - o 12.2.4 Configurable Parameters

Configuration Concerns

f 12.3 Configuration Concerns

Configuration Processes

- f 12.4 Configuration Processes: via LCD Keypad
- f 12.5 Configuration Processes: via Terminal Emulation

Operation Theory

f 12.6 Operation Theory

12.1 Configuration Samples

Design Concerns

- We assume that redundant RAID controllers and multipathing software are implemented for an environment running missioncritical applications, and that the RAID, Inc. storage subsystems applied in such environment should also come with high availability, i.e., dual-redundant RAID controllers and data path devices. On the host side, a redundant pair of single-ported HBAs is necessary.
- 2. Carefully configure your RAID arrays and select the appropriate array settings such as stripe size and write policy. Reconfiguration takes time and may require you to move/back-up your data.
- 3. Perform the similar tasks if your RAID arrays come with a more complicated mapping scheme, e.g., volumes divided into many partitions, multiple array volumes, etc.
- 4. Create at least two logical drives (LD0 and LD1) and associate (map) them equally with Controller A IDs (AID) and Controller B IDs (BID). Doing so you get the maximum work power from the dual-redundant RAID controllers. For more details on creating AIDs/BIDs and LUN mapping processes, please refer to the discussions later in this chapter 12.5 Configuration Processes: via Terminal Emulation.
- 5. Logical RAID units are manually associated with Controller A/B IDs that reside on the host channels.
- 6. Disable some configuration options for they might cause data inconsistency if module failures should occur. For example, disabling the use of buffers on individual disk drives may let you lose some performance, yet it is relatively safer for drive buffers may hold cached writes during a power outage and cause data inconsistency. The configuration option can be found in firmware's embedded utility through Main Menu -> View and Edit Configuration Parameters -> Drive-side Parameters -> Drive Delayed Write.
- 7. There are similar concerns with the mirrored cache operated between the RAID controllers. Make sure compensatory measures are applied, e.g., use of battery backup modules or UPS devices.

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Pros and Cons of Various Configurations

Co	nfiguration	Pros and Cons			
1	Simple DAS w/o Hub	Applies to single logical drive over flexible cabling.			
2	DAS w/ Hubbed Ports	Saves costs on FC switches; total host-side bandwidth can be halved.			
3	SAN w/ FC Switches	Applies to multi-server SAN; requires expensive FC switches.			
4	SAN w/ FW3.48 Mapping Method	Arrays can be associated with Controller A or Controller B IDs. In the event of host link failure, data access travels through the RCC links between RAID controllers so that a RAID controller with broken link will not sit idle.			
5	Multipathing w/ Clustered Servers	High redundancy on server side and on the storage side. I/O path re-routing is partially managed by FC switches.			

Table 12 - 1 Pros and Cons of Sample Topologies

1. Simple DAS without Hub (FW3.48 Mapping Method)

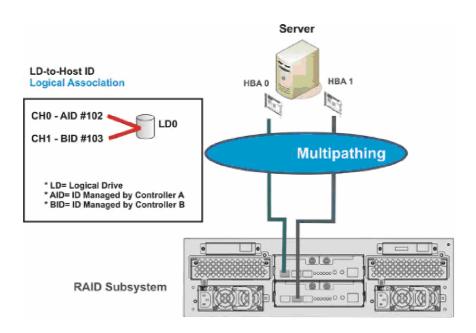


Figure 1: Simple DAS without Hub

Configuration Tasks

Tasks	Logical Drive		Channel	AID	BID
Map LD0 to an AID on channel #0.		0	0	102	N/A
Map LD0 to a BID on channel #1 for redundant-path access.	LD0	0	1	N/A	103

This configuration applies to a redundant-controller subsystem which is directly attached to a host computer without intermediate networking devices. A logical drive is associated with different Controller IDs (Controller A and Controller B) on separate host channels of different RAID controllers.



MOTE:

f You may use different channel IDs than are shown here in the sample topologies, IDs used in the sample configurations are mostly default numbers in firmware. As long as the IDs are carefully selected according to the configuration rules, there is no limitation on selecting different host channel IDs.



NOTE:

- f The mapping information here is following the traditional mapping method which allows a logical drive to be associated with IDs managed by a single RAID controller, e.g., either Controller A IDs or Controller B IDs.
- f The new mapping method (available since firmware 3.48) allows a logical drive to be managed by both counterpart controllers, i.e., a logical drive associated with both Controller A and Controller B IDs.

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2. DAS with Hubbed Ports

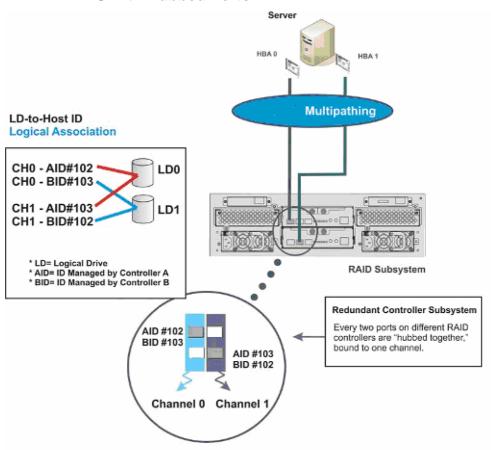


Figure 2: DAS with Hubbed Ports

Configuration Tasks

Tasks	Logical Drive		Channel	AID	BID
Map LD0 to an AID on channel #0.		0	0	102	N/A
Map LD0 to an AID on channel #1 for redundant-path access.	LD0	0	1	103	N/A
Map LD1 to a BID on channel #0.		0	0	N/A	103
Map LD1 to a BID on channel #1 for redundant-path access.	LD1	0	1	N/A	102

1. This configuration applies to a redundant-controller subsystem which is attached to a host computer with or without intermediate FC switch devices.

2. Two logical drives are separately associated with Controller A/Controller B IDs on separate host channels. Hubbed ports combines the same host ports on different controllers to a host channel and provide path redundancy in the applications without the use of FC switches.

3. SAN with FC Switches

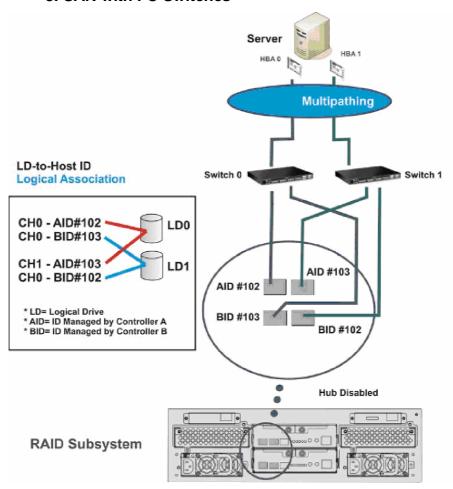


Figure 3: SAN with FC Switches

Shown above is a configuration using FC switches to facilitate the connections with multiple SAN servers. For the reason with diagram's simplicity, only one server is displayed.

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Configuration Tasks

Tasks	Logical		Channel	AID	BID
	Drive				
Map LD0 to an AID on channel #0.		0	0	102	N/A
Map LD0 to an AID on channel #1 for redundant-path access.	LD0	0	1	103	N/A
Map LD1 to a BID on channel #0.		0	0	N/A	103
Map LD1 to a BID on channel #1 for redundant-path access.	LD1	0	1	N/A	102

This configuration applies to a redundant-controller subsystem attached to host computer(s) using intermediate FC switch devices.

Fault Tolerance is achieved through the following:

- 1. Logical drives are separately associated with Controller A IDs or Controller B IDs on separate host channels.
- In the event of a cabling or single controller failure, a surviving controller or a controller holding a valid data link can access the array through an alternate host ID or ID inherited from a failed controller.
- 3. Through the intermediate FC switches or a FC switch with segregated zoning, cable/controller failure can be managed by re-routing host I/Os to a valid link.
- 4. Host IDs managed by a failed controller are automatically passed down a surviving RAID controller; for instance, Controller A IDs passed down to Controller B, in the event of controller failure.
- 5. When using FC switches, the subsystem's onboard hub functionality should be disabled.

4. SAN with FC Switches (FW3.48 Mapping Method)

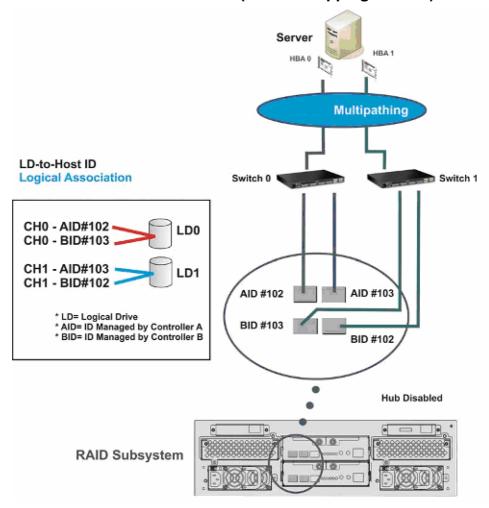


Figure 4: SAN with FC Switches & FW3.48 Mapping Method

Configuration Tasks

Tasks	Logical		Channel	AID	BID
	Drive				
Map LD0 to an AID on channel #0.		0	0	102	N/A
Map LD0 to a BID on channel #0 for redundant-path access.	LD0	0	0	N/A	103
Map LD1 to an AID on channel #1.	LD1	0	1	103	N/A

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Map LD1 to a BID on	0	1	N/A	102
channel #1 for				
redundant-path				
access.				

This configuration applies to a redundant-controller subsystem which is attached to a host computer with intermediate FC switch devices. The new mapping method requires firmware revision 3.48 or later.

Fault Tolerance is achieved through the following:

- The new mapping method allows a logical drive to be associated with IDs assigned to different RAID controllers. Associated with both Controller A and Controller B IDs, firmware can dynamically re-arrange I/O load on different I/O paths when a specific I/O path is congested with heavy load. This works with TPGS methodology which obtains I/O load statistics from RAID, Inc.'s multipathing drivers running on the host side.
- Logical drives are separately associated with a Controller A ID and a Controller B ID on the same host channel.
- 3. In the event of a cabling or single controller failure, a surviving controller or a controller holding a valid data link can access the array through an alternate ID or the host IDs inherited from a failed controller.
- 4. Through the intermediate FC switches or an FC switch with segregated zoning, cable/controller failure can be managed by re-routing host I/Os to a valid link.
- Host IDs managed by a failed controller are automatically passed down to a surviving RAID controller; for instance, Controller A IDs passed down to Controller B, in the event of controller failure.

Shown above is a configuration using FC switches to facilitate the connections with multiple SAN servers. For the reason with the diagram's simplicity, only one server is displayed here. The onboard hub saves you the expenses on FC switches in DAS applications. However, with more complex configurations using FC switches, the subsystem's onboard hub functionality should be disabled.

5. Multipathing with Clustered Servers (FW3.48 Mapping Method) Clustered Servers

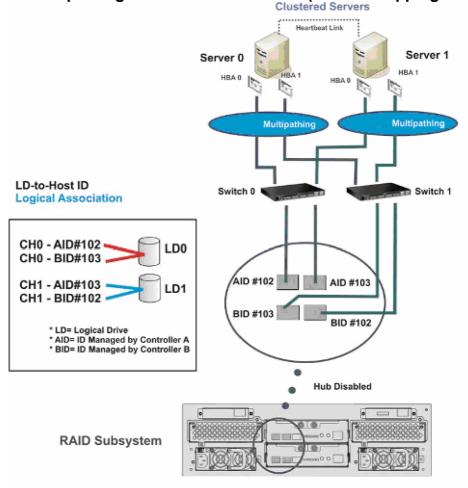


Figure 5: SAN with Clustered Servers

Configuration Tasks

Tasks	Logical		Channel	AID	BID
	Drive				
Map LD0 to an AID on channel #0.		0	0	102	N/A
Map LD0 to a BID on channel #0 for redundant-path access.	LD0	0	0	N/A	103
Map LD1 to an AID on channel #1.		0	1	103	N/A
Map LD1 to a BID on channel #1 for redundant-path access.	LD1	0	1	N/A	102

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The LUN mapping method is identical to the previous configuration. Only that the EonPath package is installed on both of the clustered servers.

12.2 Related Functions

12.2.1 Requirements for Redundant-Controller Configurations

Communications Channels

f Controller Communications (Cache Synchronization) Paths:

Controller RCC

Falcon III / Magellan / X4 Pre-configured RCC routes over the system backplane; may be SCSI, Fibre, or SATA data paths. These data paths cannot be re-assigned.

- f With dual-active controller configuration, write-back cache will be disabled if no RCC paths are present.
- f If controllers are running with write-back caching, a battery module on each controller is highly recommended.

Out-of-Band Configuration

- f RS-232C serial port cable (for terminal interface operation) connection. Normally a Y-cable will be included with dual-controller subsystems. The Y-cable ensures a valid link in the event of single controller failure.
- f Ethernet connection: If management through Ethernet is preferred, connect the Ethernet interface from both controllers to ports on an Ethernet hub. In the event of controller failure, the IP address assigned to the Primary Controller will be inherited by the surviving controller. The Ethernet port connection (management session) will be continued. An operator may have to re-enter the IP address to re-connect the controller/subsystem from a management console.

12.2.2 General Firmware Configuration **Procedures**

Below are the basic procedures for readying a redundant-controller subsystem:



Step 1. Controller Unique Identifier

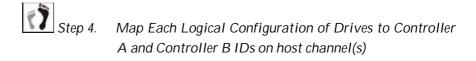
The Falcon III / Magellan / X4 subsystems usually come with a default identifier. If the default is lost for some reasons, find a unique identifier for each RAID controller.

"View & Edit Peripheral Devices" \rightarrow "Controller Parameters" \rightarrow "Controller Unique Identifier."

Step 2.	Controller A and Controller B IDs on Host Channels
Step 2-1.	"View and Edit Channels"→ Choose a host channel.
Step 2-2.	"View and Edit Fibre ID" \rightarrow Choose an ID.
Step 2-3.	Under "Add/Delete Channel ID" \rightarrow "Controller A/Controller B" \rightarrow Select an ID from the list.
Step 2-4.	Reset the controller for the configuration to take effect.
Step 3.	Create Logical Configurations of Drives and Assign Each of Them to Controller A or Controller B

этер э.	Create Logical Configurations of Drives and Assign Lacin
	of Them to Controller A or Controller B

Step 3-1.	Under "View and Edit Logical Drives"→ Select a
	Logical Drive entry.
Step 3-2.	Select a RAID level.
Step 3-3.	Select member drives
Step 3-4.	Configure other parameters, e.g., stripe size.
Step 3-5.	Create Logical Drive.



Step 4-1.		dit Host LUN" ler" Combination	→ Choose a "Host n.
Step 4-2.	•	· ·	Volume/Logical (Create Host LUN

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12.2.3 Limitations

- f Both controllers must be exactly the same. Namely, they must operate with the same firmware version, the same size of cache memory, the same number/configuration of host and drive channels, etc. If battery backup is preferred, both should be installed with a battery module.
- f If a RAID controller fails and needs to be replaced, it is often the case that the replacement controller may carry a newer revision of firmware. It is advised you provide information such as firmware revision number, boot record version, etc.
- f For a subsystem featuring Fibre host channels and if the onboard hub is not enabled, connection through Fibre switches can be necessary for configuring fault-tolerant paths between host and RAID storage.
 - In the event of data path failure, an intelligent FC switch should be able to direct data flow through an alternate path. In this case, multipathing software should be necessary to manage the many paths that are strung between host and RAID storage.
- f Your RAID subsystem may not come with sufficient number of Controller A and Controller B IDs. You may need to manually create Controller A/Controller B IDs.

12.2.4 Configurable Parameters

Active-to-Active Configuration

Since firmware revision 3.48, users can freely map any logical configuration to both the Controller A and Controller B IDs. I/O requests to the logical configuration will then be dynamically shared by both RAID controllers. When configuring a dual-controller configuration, it is best to consider the total drive capacity and the associations between RAID configurations and host IDs so that I/O load can be equally serviced by both controllers.

The dual-active configuration engages all system resources to performance. Users may also assign all logical configurations to one controller and let the other act as a standby (active-standby).

Cache Synchronization (Mirrored Cache)

The Write-back caching significantly enhances controller performance. However, if one controller fails in the redundant-controller configuration, data cached in its memory will be lost and data inconsistency might occur when the surviving controller takes over and attempts to complete the writes.

There are one or several I/O channels strung across partner controllers to serve as the communications paths. Cached writes are distributed to both controllers and each controller saves an exact replica of the cache content on its counterpart. In the event of controller or power failure, the unfinished writes will be completed by the surviving controller.

Battery Support

Unfinished writes will be cached in memory in write-back mode. If power to the system is discontinued, data stored in the cache memory will be lost. Battery modules can support cache memory for several days allowing RAID controllers to keep the cached data. When two controllers operate using the write-back mode, it is recommended to install a battery module to each controller.

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12.3 Configuration Concerns

Listed below are the configuration concerns and phenomena you will encounter when configuring a redundant-controller subsystem:

- f By system default, Controller A is always the primary RAID controller. Controller B in the lower slot serves as the secondary. If Controller A fails and is replaced afterward, firmware returns the Primary role to the replacement controller after a system reboot.
- f Shortly after a subsystem is powered up, the LCD will display "RC connecting." After the controller negotiation is completed, the communications between controllers should be established.
- f The traditional mapping method co-exists with the new, cross-controller access available with the 3.48 release. With firmware revision 3.48, any logical configurations of drives can be associated with both Controller A and Controller B IDs.

Firmware before rev. 3.48	A RAID configuration can only be managed by one controller.
Firmware rev. 3.48	A RAID configuration can be alternatively managed by both RAID controllers.

One benefit of the cross-controller access is that when a host link fails, I/Os can travel through the counterpart controller, the RCC link, and then back to the RAID controller originally managing the array.

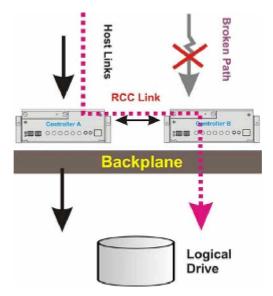


Figure 12 - 6 Routing Access when a Host Link Fails

- f If your subsystem comes with an LCD, the upper right corner of LCD will then display a "P" or "S," meaning "Primary" or "Secondary" respectively. You may press the arrow keys together for two seconds to switch between the display of the Primary or Secondary controller status.
- f The controller partners synchronize each other's configurations at frequent intervals through the communications channel(s).

12.4 Configuration Processes: via LCD Keypad

1. Controller Unique ID

Enter "View and Edit Config Parms"-> "Controller Parameters". Use the up or down arrow keys to find "Ctlr Unique ID- xxxxx".

This value will be used to generate a controllerunique WWN node name and port names and to identify the controller during the failover process. Enter a hex number from 0 to FFFFF and press [ENTER]. The value you enter should be different for each controller. If the controller comes with defaults, it is recommended to use them.

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2. Creating Primary and Secondary IDs

Host Channel



Step 1. In "View and Edit Channels", press [ENT] to select a host channel.

CHL=0 ID=0 Slot A Ctlr ..



Step 2. Use the up or down arrow keys to select "Set Channel ID". A preconfigured ID will appear, press [ENT] to proceed.



Step 3. Use the up or down arrow keys to select "Add Channel ID" and then press [ENT] for two seconds on the "Controller A" or "Controller B?" to proceed.

Add Channel
ID ..

?

Slot A

Controller



Step 4. When prompted by this message, use the arrow keys to select an ID. Press [ENT] to confirm.

Add CHL=0 ID= $\frac{2}{?}$



Step 5. A message will prompt to remind you to reset the controller. Press [ENT] to reset the controller or press [ESC] to return to the previous menu. The change of ID will only take effect after a system reset.

Change Setting Do Reset Ctlr ?

3. Logical Drive Assignments (Dual-Active Controllers)

A logical drive, logical volume, or any of its logical partitions can be assigned to either Controller A or Controller B. By default, a logical drive is automatically assigned to Controller A, controller installed in the upper controller slot, which as a factory default, the Primary controller. To divide the workload, you may manually assign a logical drive to Controller B if the host computer is also connected to Controller A.

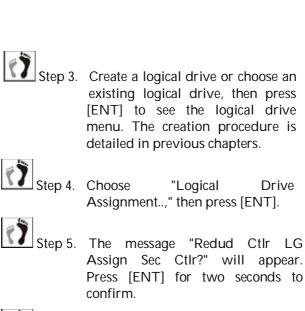


Step 1. Press [ENT] key for two seconds to enter the firmware utility's Main Menu.



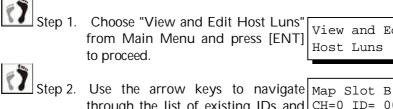
Step 2. Use the arrow keys to navigate through the configuration menus. Choose "View and Edit Logical Drives", then press [ENT].

View and Edit Logical Drives



Step 6. Map the logical drive (or any logical unit) to a host ID or LUN number under the designated controller B ID. The host channel must have a "Slot B" ID. If not available, Slot B IDs can be manually added to a host channel.

4. Mapping a Logical Drive/Logical Volume to the Host **LUNs**



through the list of existing IDs and CH=0 ID= 000

View and Edit

Host Luns

Logical Drive

Redud Ctlr LG

Assign Slot B?

Assignment..

Step 3. Use the arrow keys to select Map to mapping to a "Logical Drive" or Logical Drive ? "Logical Volume" to host LUNs. If logical unit has partitioned, map each partition to different IDs/LUNs.

press [ENT] to select one of them.

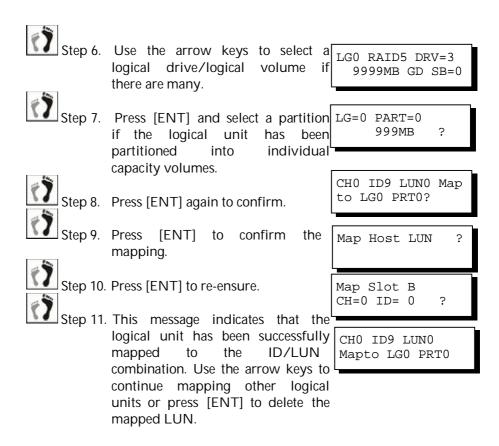
Step 4. Use the arrow keys to choose a LUN number and press [ENT] to confirm.

CHO IDO LUNO No Mapped

Step 5. Press [ENT] again to confirm.

Map Host LUN

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Repeat the process to map all the logical units to host ID/LUNs.

5. Front Panel View of Controller Failure

What will happen when one of the controllers fails?

If one of the controllers fails, the existing controller will automatically take over within a few seconds.

The red ATTEN LED will light up, and the Redundant Ctlr message "Redundant Ctlr Failure Detected" will Failure Detected appear on the LCD. Users will also be notified by L audible alarm.



NOTE:

- Although the surviving controller will keep the system working, you should contact your system vendor for a replacement controller as soon as possible. Your vendor should be able to provide an appropriate replacement.
- Some operating systems (SCO, UnixWare, and OpenServer, for example) will not attempt to retry accessing the hard disk drives while controller is taking over.

When and how is the failed controller replaced?

Remove the failed controller after the "working" controller has taken over. For the ventilation concern in most enclosures, it is better to leave a failed controller in place before a replacement arrives. For a controller with hotplug capability, all you have to do is to replace the failed controller.



NOTE:

- If you power down the surviving controller and power up both controller together, problems might occur for they might contend for the role of the Primary controller.
- f Check if the replacement is properly installed.

Redundant controller subsystems are designed to withstand a single controller failure. If the replacement does not initialize properly, try the following:

When the replacement is connected, the "Auto-Failback" process should start automatically. If the replacement controller does not initialize, you may execute the following steps to bring the new controller online.



Step 1. Press [ENT] for two seconds on the existing controller to enter the Main Menu.



Step 2. Use the arrow keys to select "View View and Edit and Edit Peripheral Dev..," then press [ENT].

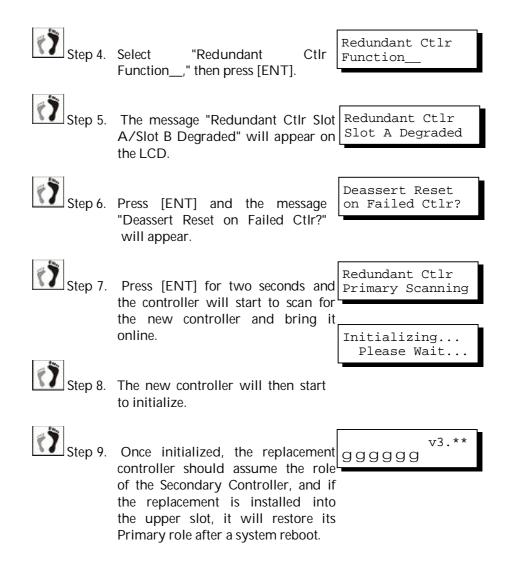
Peripheral Dev



Choose "Set Peripheral Device Entry..," then press [ENT].

Set Peripheral Devices Entry

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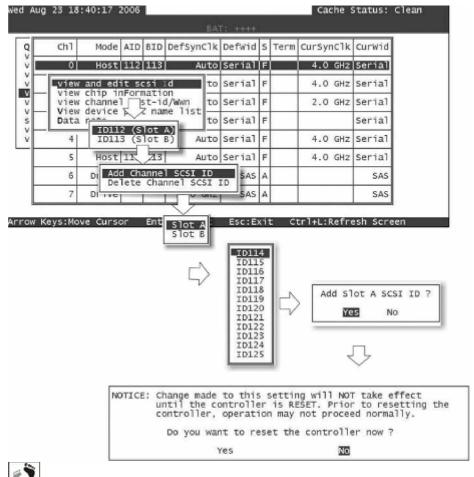


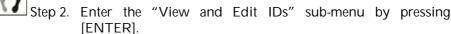
12.5 Configuration Processes: via Terminal Emulation

Power on all hard drives and the two controllers. If drives are installed in a drive enclosure, wait for the drives to be ready, then power on the primary RAID enclosure.

12.5.1. Creating Controller A and Controller B IDs

Step 1. Enter "View and Edit Channels," then press [ENTER] and select the host channel on which you wish to create Controller A or Controller B IDs.







Step 4. Select "Add Channel SCSI ID." Press [ENTER] to confirm.

Step 5. Select either "Slot A" or "Slot B" controller to create IDs that will be managed by a designated RAID controller.

Step 6. A pull-down list will display all available IDs. Use your arrow keys to select an ID and press [ENTER] to confirm.

The configuration change will only take effect after a system reboot.

12.5.2. Logical Drive Assignment (Dual-active RAID Controllers)

A logical drive can be assigned to the Slot A or Slot B controller.

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Step 1. Access "View and Edit Logical Drives" from the Main Menu. Create a logical drive by selecting members and then a selection box will appear on the screen.

Thu Ju'	21 17:18	3:22	2005										Cach	e Sta	atus: Clean
BAT:+++++															
LG	ID	LV	RAID	Size	(MB)	Status	1	2	3	0	c	⊭LN	#5B	#FL	NAME
0			NONE												
Cr	Create Logical Drive ?														
Yes No															
3			NONE	1											
4			NONE												
5		П	NONE												
6			NONE												
7			NONE												

Arrow Keys:Move Cursor | Enter:Select | Esc:Exit | Ctrl+L:Refresh Screen



For the first logical drive on the RAID subsystem, simply choose the first logical drive entry, LG 0, and press [ENTER] to proceed. You may create as many as 32 logical drives or more using drives in a RAID subsystem or in a cascaded enclosure.





When prompted to "Create Logical Drive?," select Yes and press [ENTER] to proceed. Please refer to the previous chapters for options specific to individual logical drives.

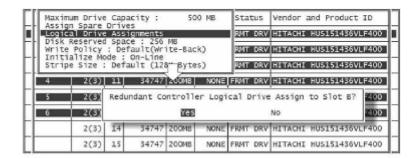


NOTE:

By default, logical drives will be automatically assigned to the Slot A controller. It can be assigned to the Slot B controller if the host computer is also connected to the Secondary controller.



Access "View and Edit Logical Drives" from the Main Menu. Move the cursor bar to "Logical Drive Assignments" and press [ENTER] if you want to assign logical drive to the Secondary controller.

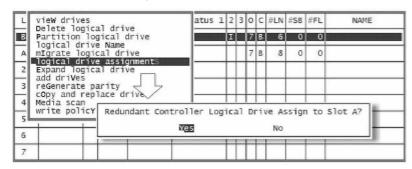


Step 5.

Logical drive assignment can also be changed after a logical drive is created. Select an existing logical drive, then press [ENTER] to see the logical drive menu.



Select "Logical Drive Assignments," then press [ENTER]. Choose Yes and press [ENTER] to confirm reassignment to the Secondary controller.



The reassignment is evident from the "View and Edit Logical Drives" screen. "S0" indicates that the logical drive is Logical Drive #0 assigned to the Secondary controller.

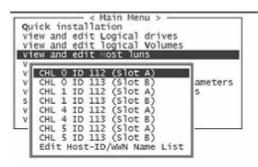
Mapping a Logical Drive/Logical Volume to the Host LUNs.



TIPS:

- 1. Before proceeding with the mapping process, draw an abstract diagram of your configurations to help clarify the relationships among physical and logical components.
- 2. Before the mapping process, check if you have properly configured logical drives, logical drive assignment, and host IDs.

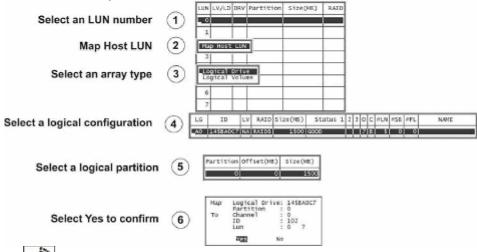
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Step 1. Enter the "View and Edit Host LUNs" menu. A list of existing host IDs will be displayed.

Step 2. Select a host ID (either a Controller A or Controller B ID) by pressing [ENTER]).

Step 3. Select the type of logical unit (Logical Drive or Logical Volume) you wish to associate with the host ID.



Step 4. Select an LUN number under the host ID.

Step 5. All available logical units will be listed. Select one of them by pressing [ENTER] on it.

Step 6. When selected, all logical partitions under the logical unit will be listed. Select a partition.

Step 7. A confirm box will appear. Verify the details and press [ENTER] on Yes to complete the mapping process.

Repeat this process until you finish mapping all logical units to the host IDs you prefer.

Terminal View of Controller Failure

What will happen when one of the controllers fails?

- When one of the controllers fails, the other controller will take over in a few seconds.
- 2. There will be an alert message that reads "Redundant Controller Failure Detected."

Alert

Controller ALERT: Redundant Controller Failure Detected

- 3. Users will be notified by audible alarm.
- 4. After a controller takes over, it will act as both controllers. If the Primary Controller failed, the Secondary Controller becomes the Primary.



NOTE:

f Some operating systems (SCO, UnixWare, and OpenServer, for example) will not automatically retry accessing the hard disk drives while the controller is taking over.

12.5.3 When and How Is the Failed Controller Replaced?

Remove the failed controller after the take-over of the "working" controller has been completed. For a controller with hot-plug capability, all you have to do is to remove the failed controller. With ventilation considerations, it is recommended to leave a failed controller in most enclosures until the replacement controller arrives.



IMPORTANT!

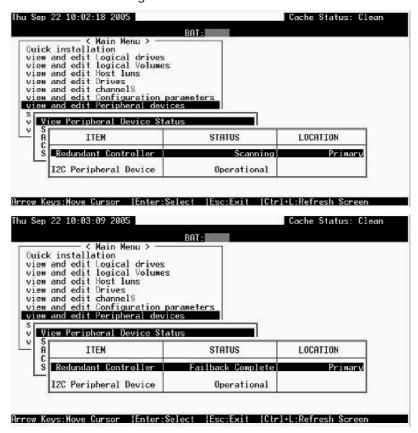
- f If you power down the surviving controller and power up both controller together, problems might occur for they might contend for the role of the Primary controller.
 - Insert a replacement controller when the surviving controller is managing the subsystem.
- f Check if the replacement is properly installed.

When the new controller is connected, the existing controller will automatically start initializing the replacement controller. If the replacement controller failed to initialize, try the following:

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If the replacement has been initialized successfully, you may proceed to examine the system status. From the Main Menu, select "View and Edit Peripheral Devices" and then "View Peripheral Device Status" to see that the new controller is being scanned.



When the scanning is completed, the status will change to "Failback Complete."

12.5.4. Redundant Controller Diagnostics



WARNING!

f This function should only be performed for testing the controller failover/failback functionality before any critical data is committed to the disk drives. Although the RAID controller is designed to be hotswappable, unpredictable faults may occur during the process, e.g., improper handling of the controller module.

Forcing Controller Failover for Testing



Testing the failover functionality can be performed using the following methods.

Pulling out one of the controllers to simulate controller failure

Pull out either the Primary or the Secondary Controller to simulate controller failure. An error message will occur immediately and the alarm will sound. The existing controller takes over the workload within a second. You may then clear all messages by pressing the ESC key for several times. You may then re-install the removed controller after all activities have been taken over by the existing controller. It may take a while for the controllers to finish re-initialization and assuming their load.

2. "Forcing controller failure"

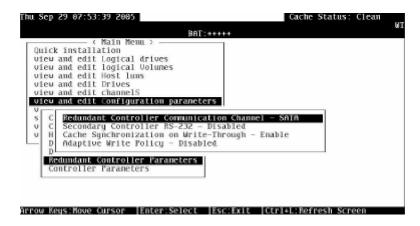
Select "View and Edit Peripheral Devices," "Set Peripheral Device Entry," and "Redundant Controller Primary/Secondary."

Select "Force Primary/ Secondary Controller Failure." You may now

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pull out the controller you had just disabled. I/Os should be continued by the existing controller. Continue the aforementioned procedure to complete the test.

12.5.5.RCC (Redundant Controller Communications Channel) Status



This item is for display only, showing the current communications routes.

12.5.6 Adaptive Write Policy



Firmware is embedded with intelligent algorithms to detect and to adapt the array's caching mode to the characteristics of I/O requests. The capability is described as follows:

1. When enabled, the adaptive write policy optimizes array performance for sequential writes.

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- 2. The adaptive policy temporarily disables an array's write-caching algorithm when handling sequential writes. Write-caching can be unnecessary with sequential writes for that write requests can be more efficiently fulfilled by distributing writes directly onto disk drives following the receiving order.
- 3. The adaptive policy changes the preset write policy of an array when handling I/Os with heterogeneous characteristics. If firmware determines it is receiving write requests that come in a sequential order, the write-caching algorithm is disabled on the target logical drives.

If the subsequent I/Os are fragmented and are received randomly, firmware automatically restores the original write-cache policy of the target logical drives.

Adaptation for the Redundant Controller Operation

4. If arrays managed by a redundant-controller configuration are configured to operate with write-back caching, cached data will be constantly synchronized between the partner controllers. Upon receiving sequential writes, firmware disables write-caching on target arrays and also the synchronized cache operation.

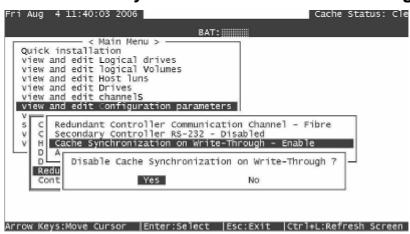


IMPORTANT!

- f If the size of an array is larger than 16TB, only the optimization for sequential I/O can be applied. A logical drive of this size is not practical; therefore, there is actually no limitation on the combination of optimization mode and array capacity.
- f Every time you change the Caching Parameters, you must reset the controller for the changes to take effect.
- f In the redundant controller configuration, write-back will only be applicable when there is a synchronized cache channel strung between partner controllers.
- f The Adaptive Write Policy is applicable to subsystems working in the normal condition. If, for example, a drive fails in an array, firmware automatically restores the array's original write policy.

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12.5.7 Cache Synchronization on Write-Through



If your redundant controller system is not operating with Write-back caching, you can disable the synchronized cache communications between RAID controllers. Your system can be spared of the efforts to mirror and transfer data between partner controllers. This increases array performance for subsystems that operate without write caching.

Note that the configuration changes made to the RAID subsystem will still be synchronized between the partner controllers.

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12.6 Operation Theory

12.6.1 Grouping Hard Drives and LUN Mapping

Inter-Controller Relationship

With subsystems built on the new ASIC266/400 chipsets, a slot A/slot B position principle is applied. The new position principle helps ensure the fixed location of a dominating, "Primary," controller. Array management, ID/LUN mapping and array operation remain basically unchanged using the traditional and the new principles.

The new principle defines the RAID controller installed in Slot A, usually the upper controller slot, as the Primary controller. The factory defaults ensures the Slot A controller always behaves as a Primary controller. In normal operating conditions, the Slot A controller should always be the Primary controller. In the conditions described below, a slot A controller might temporarily serve as a Secondary controller.

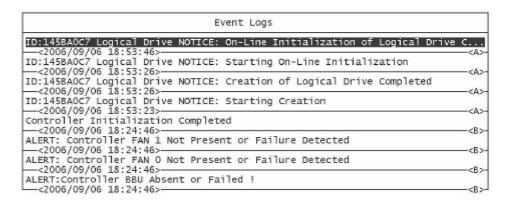
- 1. If the Slot A controller fails, the original Slot B (Secondary) controller takes over and becomes the Primary controller.
- 2. If the slot A controller is replaced by a new controller, the slot A controller temporarily serves as the Secondary controller.
- 3. Once the subsystem is reset or powered on again, firmware returns the Primary role to the controller installed in slot A.

Configuration Rules: Logical Drives, Logical Volumes, and Logical Partitions

Listed below are the basics about configuring RAID arrays on a subsystem using dual-active controllers:

- 1. All configuration utilities are managed by the Primary RAID (normally the controller A) controller.
- Controller B status can also be displayed on a terminal or LCD screen. Management screen of a specific RAID controller is indicated by a flashing digit, <A> or respectively.

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- In redundant mode, two controllers behave as one, and there is no need to repeat the configuration on another controller. Configuration profile is automatically synchronized between the controllers.
- 4. Disk drive and array configuration processes are the same for subsystems using single or dual-active controllers.
- 5. Using logical drives as the basic configuration units, system workload can be distributed to different RAID controllers. Logical units can be manually assigned to different (Controller A or Controller B and consequently Primary or Secondary) controllers to facilitate the active-active configuration.
- Users can designate a host ID either as a Controller A or as a Controller B ID. The Controller A/B IDs then function as the designators for workload assigned to different RAID controllers.
- 7. There is no limitation on drive allocations. The members of a logical drive do not have to come from the same drive channel. Grouping drives from different drive channels helps reduce the chance of downtime caused by a channel bus, chip, or cabling failure.
- 8. Each logical drive can be configured in a different RAID level and several logical drives can be striped together to compose a larger logical volume.
- 9. 9-1. Each of the logical units (a logical drive, logical volume, or one of their partitions) can be made available on one or more host ports using the host LUN mapping options.
 - 9-2. Each of them can be "associated" with one or more host ID/LUNs. Each of these associated host ID/LUNs appears to the host operating system as a virtual storage volume.

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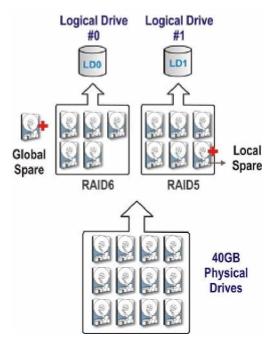


Figure 12 - 7 Grouping Hard Drives

10. As diagrammed above, array composition can be very flexible. You may divide a logical drive or logical volume into several partitions as diagrammed below, or use the entire logical drive as a single partition, with or without the support of one or several spare drives.

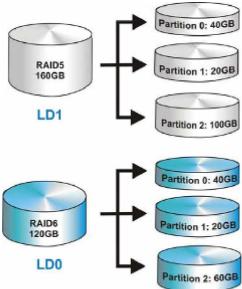


Figure 12 - 8 Partitioning of Logical Units

11. Each logical unit can be associated (mapped) with one or more host IDs (pre-configured as a Controller A or a Controller B ID) or the LUN numbers under these host IDs.

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12.6.2 System Drive Mapping

Controller A and Controller B IDs

f Host Channel

When controllers are successfully combined, the array capacity is made available through host bus IDs, and these IDs are available as "Controller A" or "Controller B" IDs. In addition to the default IDs, more IDs can be added through the associated pull-down menus from the user interface.

Relationship between Controllers

► New (FW 3.47 or above) Configuration Rule:

Described previously in the *Inter-Controller Relationship*.

► Traditional Configuration Rule:

There are no specific regulations on the locations of the Primary/Secondary controllers, before or after a controller failure.

Create IDs

You may have to create Controller A and Controller B IDs separately on the host, if these IDs are not available. The configuration procedure has been detailed in 12.5 Configuration Processes: via Terminal Emulation.

Mapping

- f Since firmware release 3.48, a logical unit can be associated with both Controller A or Controller B IDs.
- f Fault Conditions: The physical paths from disk drives to host busses are diagrammed below in normal and controller failure conditions.

Redundant Controller 12-35

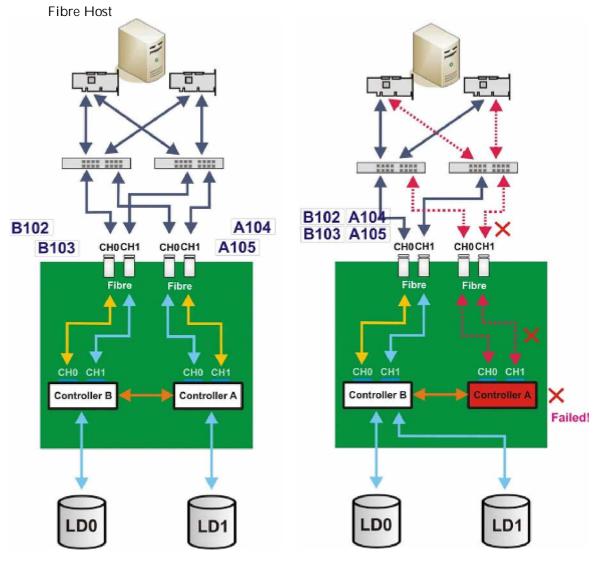


Figure 12 - 9 Redundant-controller Subsystem in Normal/Degraded Conditions

With Fibre-host subsystems, host channels on partner controllers are usually separately routed to independent host ports. It is necessary to associate a logical drive with more than one host IDs on different host ports. If made available on more than one host port, host I/Os will continue when a host link component (HBA or FC cable) fails.

If an application server can access the arrays through fault-tolerant paths, multi-path management software, such as RAID, Inc. EonPath, should be available.

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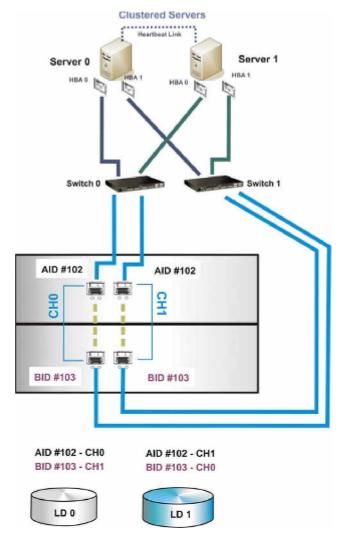


Figure 12 - 10 Mapping Array Volumes to Different Controllers

f As diagrammed above, each logical drive is associated with two channel IDs on different controllers and on different host channels. This ensures continuous host access in the event of cabling component or RAID controller failure.

Note the following when configuring fault-tolerant configurations:

- 1. Different ID numbers should be used on the same channel to avoid ID conflicts when all IDs shift to a surviving controller in the event of controller failure.
- 2. Multi-path management software should be installed on the host computers to manage the access to the same array volume via two different I/O paths.

Redundant Controller 12-37

f Each channel ID (or an LUN under target ID) will appear as one virtual storage volume to the host operating system.

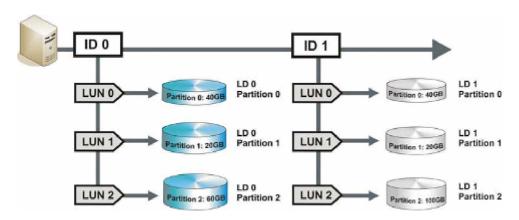


Figure 12 - 11 Mapping System Drives (Mapping to LUNs)

f Shown below is a SCSI host bus teamed with multiple IDs/LUNs that are associated with logical partitions.

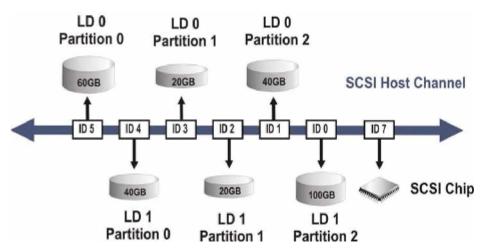


Figure 12 - 12 Mapping System Drives (an Example on a SCSI bus)

f Some older operating systems do not read multiple LUNs under a target ID. As diagrammed above, you may have the host channel to present several IDs and map logical configurations to these IDs. Each of these IDs can be identified as "Controller A ID" or "Controller B ID." As a rule for most operating systems, each configuration unit will then be mapped to LUN 0 under each ID.

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12.1.2 Fault Tolerance

Why Using a Redundant Controller Configuration?

- 1. Hardware failures can occur. A simple parity error can sometimes cause a RAID system to completely hang.
- Having two controllers working together will guarantee that at least one controller will survive catastrophes and keep the system working.
- When dealing with high-availability applications, redundancy is always a virtue. This is the logic behind having redundant controllers – to minimize the chance of down time for a storage subsystem.

A redundant-controller system uses two controller modules to manage the storage arrays. It requires two identical controllers to work together and both must be working normally. During normal operation, each controller serves its I/O requests. If one controller fails, the existing controller will temporarily take over for the failed controller. The failover and failback processes are completely transparent to the host (sometimes with the help of intelligent FC switch firmware) and require only minimum efforts to restore the original configuration.

Controller Failover and Failback

In an unlikely event of controller failure, the surviving controller will acknowledge the situation and disconnect from the failed controller. The surviving controller will then act as both controllers and serve all the I/O requests from host.

System failover is transparent to host. System vendors should be contacted for an immediate replacement of the failed unit.

Replacing a Failed Unit:

The replacement controller should have the same amount of memory and run the same version of firmware. However, it is inevitable a replacement controller will be running later revisions of firmware. To solve this problem, you should manually downgrade the replacement's firmware or inform your supplier of the firmware version currently running on your subsystem.

Your system vendor should be able to provide an appropriate version of firmware and replacement controller.

Redundant Controller 12-39

Auto-Failback

Once the failed controller is removed and a replacement controller is installed, the existing controller will acknowledge the situation. The existing controller should automatically attempt to combine with the replacement controller.

When the initialization process of the replacement controller is completed, the replacement controller should always inherit the status of the Secondary controller.



IMPORTANT!

For a subsystem powered by the ASIC266 or later chipset, reset the subsystem if the replaced controller resides in slot A. If the replacement controller in slot A is successfully combined, a system reset should restore its status as the Primary controller.

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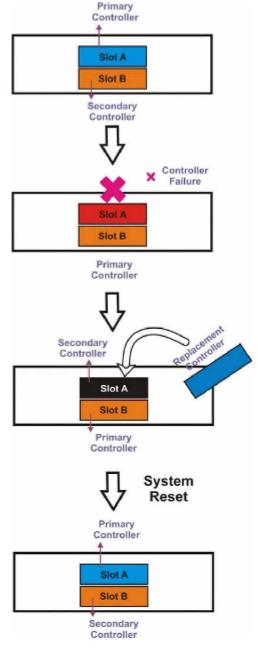


Figure 12 - 13 Controller Primary-Secondary Relative Positions

- A typical controller failover and failback process is diagrammed on the left.
- State 1: Subsystem operating normally.

 Slot A controller is the Primary controller by factory default.
- State 2: Slot A controller fails. Slot B controller inherits the Primary role.
- State 3: The failed controller in Slot A is replaced by a healthy one. The replacement controller becomes the Secondary controller temporarily.
- State 4: If the subsystem resets later, the Slot B controller returns the Primary role to the Slot A controller.

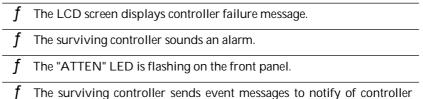
If the subsystem is reset later, the controller installed in the Slot A position will obtain the Primary controller status. The Slot B controller then resumes the Secondary role. The replacement controller will obtain all related configuration parameters from its counterpart.

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E. Controller Failure

Controller failure is managed by the surviving controller (regardless of its original role as Primary or Secondary). The surviving controller disconnects from its counterpart while gaining access to all signal paths. The existing controller then proceeds with the ensuing event notifications and take-over process.

Symptoms



failure (indicating its partner has failed).

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Firmware Functionality Specifications

A.1 Basic RAID Management:

Specification	Feature
RAID levels	0, 1(0+1), 3, 5, 6, 10, 30, 50, 60, JBOD and NRAID.
	Levels 10, 30, 50, and 60 are the multi-level
	RAID defined as the logical volume
	implementations; logical volumes consist of
	logical drives of different RAID levels that are
	striped together.
Maximum number of	16 as default, up to 32 with a 1GB or above
logical drives	memory size
Maximum logical drive	64TB – when optimization mode is set to
capacity	Sequential
	16TB – when optimization mode is set to Random
RAID level	Independent. Logical drives configured in
dependency to each	different RAID levels can co-exist in a logical
logical drive	volume and within a RAID subsystem
Maximum number of	128 - 512MB memory size
logical drive members	112 - 256MB memory size;
	(theoretical number, not recommended for the
	difficulties with backup and management
	troubles)
Configurable stripe	4KB, 16KB, 32KB, 64KB, 128KB, 256KB, 512KB,
size	or 1024KB per logical drive
	f 128KB is the default for earlier firmware with
	optimization for Sequential I/Os
	f 32KB is the default for earlier firmware with
	optimization for Random I/Os
Configurable Write	Write-Back or Write-Through per logical drive.
Policy	This policy can be modified later.
(write policy per array)	

I and a Litera	I I - 2
Logical drive	Unique, controller randomly generated logical
identification	drive ID;
	Logical drive name user-configurable for ease of
Maximum number of	identification in a multiple arrays configuration
partitions for each	8 as default, up to 64 with a 1GB memory size
logical drive	
Maximum number of	16 as default, up to 16 with a 1GB or above
logical volumes	memory size
Maximum number of	Default is 128, up to 1024 with a 1GB or above
LUNs Mappable	memory size
Maximum number of	Up to 32, user configurable
LUNs per host ID	grand
Maximum number of	16
Media Scan task	
schedules	
Concurrent I/O	Supported
Tag Command	Supported
Queuing (TCQ)	
Native Command	Supported
Queuing (NCQ)	
Dedicated spare drive	Supported, hereby defined as the spare drive
Clabal an ana dular	specifically assigned to a logical drive
Global spare drive	Supported, the spare drive that serves all logical
	drives (as long as it is equal in size or larger than logical drive members)
Global spare auto-	Supported, applies to non-configured drive(s);
assign	safeguards the array if a spare has been used in
	the previous array rebuild and users forget to
	configure a new drive as a spare.
Enclosure spare drive	Spare that participates in the rebuild of the failed
	drive within the same enclosure.
Co-existing Dedicated	Supported
(Local), Enclosure-	
specific, and Global	
spare drives	
Auto-rebuild onto	Supported
spare drive	
Auto-scan of	Supported
replacement drive	
upon manually initiated rebuild	
One-step rebuild onto	Supported
a replacement drive	Oupported
Immediate logical	Supported;
drive availability	Logical arrays are immediately ready for Host
	I/Os. Initialization task is completed in the
	background except when the logical array is
	stated as "INCOMPLETE" or "BAD;" e.g., has a
	failed member right after the creation.
Auto-rebuild onto	Supported. With no spare drive, the subsystem
failed drive	will auto-scan the failed drive and starts rebuild
replacement	automatically once the failed drive has been
	replaced.

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Concu expar	ırrent rebuild / nsion	Rebuild/	logical drives can pro Regenerating Parity,	and/or
		Expansion the same	on/Initialization/Add Di e time.	rive operation at
		NOTE:		
			rate Parity and Rebuil cal drive at the same	
		Create. I	Expand, and Add Driv	re operations
			ake place on a logical	
		time.		
	round firmware		e can be downloaded	
downl			s effect after system	
	ecovery from I drive failure	Supported. If a user accidentally removed the		
	guration on	wrong drive to cause the 2nd drive failure of a		
drives		one-drive-failed RAID5 / RAID3 logical drive, fatal error may occur. However, you may force the		
	•		em to reaccept the log	
			g off the subsystem, in	
		back to i	ts original drive slot, a	and then power on
			ystem. You may have	
			he logical drive into th	ne one-drive-failed
		status.		
	NOTE:			
	To ensure smootl	n operation	n, sufficient cache me	mory buffer is
			made up of numerous	
	intelligent trigger	- mechanisr	n is implemented with	n firmware version
	3.47 and later. If a subsystem/controller comes with a DIMM			
	module of the size equal or larger than 1GB, firmware automatically			ware automatically
	enlarges the max	imum num	bers of logical units.	DUM
	Manager		DIMM size < 1G	DIMM size >= 1G
	Max. no. of LD		16	32
	Max. no. of LV	r I D/I \/	8 16	16 64
	Max. partitions pe	I LU/LV	128	1024
	IVIAX. HU. UI LUIN		120	1024

A.2 Advanced Features:

Media Scan	Supported. Verify written data on drives to avoid bad blocks from causing data inconsistency. If bad blocks are found, data can be reconstructed by comparing and recalculating parity from adjacent drives (RAID1/3/5/6).
	The "Reconstruction Writes" are followed by "Write Verification" operation.

Bad Block Handling in degraded mode	A method for handling low quality drives. The operation is performed on both the logical drive in degraded mode or those that are being rebuilt. If bad blocks should be encountered during Rebuild, Add Drive, Host Write, or Regenerate Parity operation, the controller will first attempt to reconstruct affected data and those unrecoverable bad blocks are stated as bad and the controller return to host.
	Users have the option to abandon data on the unrecoverable sectors to continue rebuild in a degraded mode.
	Low quality drive handling comes with transparent resetting of hung hard drives.
Transparent reset of hung HDDs	Supported
Auto cache flush on critical conditions (caching mode	When critical conditions occur, e.g., component failure, or BBU under charge, cached data will be flushed and the write policy will be changed to write-through mode.
dynamic switch)	Configurable "Trigger Events" for Write-through/Write-Back Dynamic Switch. The configuration can also be set with the OEM "lappend" utility.
RAID parity update tracking and recovery	Yes, to avoid write holes.
Host-side Ordered Tag support	Supports write commands with embedded Ordered Tags.
Drive identification (flash drive function)	Supported. Force a drive to light on its activity indicator for users to visually recognize its position in a configuration consisting of numerous disk drives.
Drive information listing	Supported. Drive vendor name, model number, firmware revision, capacity (blocks), serial number, narrow/wide and current sync. speed
Drive read/write test	Supported
Configuration on disks (Drive Roaming)	Supported. The logical drive information is recorded on drive media. The logical drives can still be accessed if using different RAID, Inc. RAID controllers/subsystems, e.g., drives removed and installed in a different subsystem.
Save/ restore NVRAM to / from disks	Supported. Save all the settings stored in the controller NVRAM to the logical drive members. Now this feature comes with an option whether to restore the previously saved password in case an administrator changed the password some time before.

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0	0
Save / restore NVRAM to / from a file	Supported. Save all the settings stored in the controller NVRAM to a file (via GUI manager) on user's computer.
	Now this feature comes with an option whether to restore the previously saved password in case an administrator changed the password some time before.
Host-side 64-bit LBA support	Supports array configuration (logical drive, logical volume, or a partition of them) of a capacity up to 64TB.
Host LUN geometry: user configurable default geometry (Solaris OSes)	On FW 3.48, this feature comes with preset combinations of head, cylinder, and sector variables.
User configurable geometry range:	Sector: 32, 64, 127, 255 or Variable Head: 64, 127, 255 or Variable Cylinder: <1024, <32784, <65536 or Variable
Drive motor spin-up	Supported. The controller will send spin-up (start unit) command to each drive at the 4 sec. intervals.
Drive-side tagged command queuing	Supported. User adjustable up to 128 for each drive.
Host-side maximum queued I/O count	User adjustable up to 1024
Maximum concurrent host LUN connection	User adjustable up to 64
Number of tags reserved for each Host-LUN connection	User adjustable up to 256
Controller shutdown	Flushes cached contents upon the detection of critical conditions, e.g., a high temperature condition persists for a long time.
Drive I/O timeout	User adjustable
I/O channel diagnostics	Supported; please contact your dealer for more details.
Drive Spindown Idle Delay	Allows users to spin down hard drives when the subsystem has been idle for certain period of time.
Maximum Drive Response Time (Guaranteed Latency I/O)	User adjustable from 160 to 960ms. If a disk drive fails to return data on read requests before the timeout value is exceeded, the array immediately generates data from the parity data and the other members of a logical drive.

A.3 Caching Operation:

Write-back cache	Supported.
Write-through cache	Supported.

Supported memory	DDR mem	ory for enhanced per	formance	
type	Fast Page Memory with Parity for enhanced data			
36.	security.			
Read-ahead	Intelligent and dynamic read-ahead operation for			
operation	ı .	processing sequential data requests.		
Multi-threaded		al parameters adjust		
operation		mber of outstanding I	/Os.	
Scatter / Gather	Supported			
I/O sorting	performan			
Adaptive Write-		r performance when		
back/Write-through		writes, firmware temp		
switching		cache and the synch between partner conti		
		ective RAID controller		
		ally restores the write-		
		ng random and small		
Periodic Cache		can be configured to f		
Flush	contents in	memory at every pre	set interval:	
	1.	If data integrity is of	f the concern,	
		e.g., the lack of a b	attery backup	
		protection.		
	2.	Cache flush on pres	set intervals to	
	avoid the latency when cache			
		memory is full due t		
Variable stripe size		Opt. for	Opt. for	
	DAIDO	Sequential I/Os	Random I/Os	
	RAID0	128	32	
	RAID1	128	32	
	RAID3	16	4	
	RAID5 RAID6	128	32	
	KAIDO	128	32	
Caching Optimization				
Cache buffer so	rting prior to	cache flush operation	n.	
Gathering of wr	ites during fl	ush operation to mini	mize the number	
of I/Os required for parity update.				
 Elevator sorting and gathering of drive I/Os. 				
 Multiple concurrent drive I/Os (tagged commands). 				
 Intelligent, predictive multi-threaded read-aheads. Multiple, concurrent host I/O threads (host command queuing). 			5.	

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A.4 RAID Expansion:

On-line RAID expansion	Supported. Capacity brought by array expansion is immediately ready for Host I/Os when its
	status changes from "EXPAND" to "INITIALIZING." Initialization task is then completed in the background except when the logical array is stated as "INCOMPLETE" or "BAD;" e.g., has a failed member right after creation.
Mode-1 RAID expansion - add drive	Supported. Multiple drives can be added concurrently. Though not recommended, Add Drive can even be performed in the degraded mode.
Mode-2 RAID expansion – copy and replace drives	Supported. Replace members with drives of larger capacity.
Expand capacity with no extra drive bays required	Supported in Mode 2 RAID expansion, which provides "Copy and Replace Drive" function to replace drives with drives of greater capacity. Protect your investment for there is NO need for hardware upgrade, e.g., adding a new enclosure for the extra drives.
Operating system support for RAID expansion	No. No operating system driver required. No software needs to be installed for this purpose.

A.5 S.M.A.R.T. Support:

	T	
Copy & replace drive	Supported. User can choose to clone a member drive showing symptoms of defects before it fails.	
Daily or O M A D T		
Drive S.M.A.R.T.	Supported, with intelligent error handling	
support	implementations.	
User selectable modes	1. Detect only	
for S.M.A.R.T.	2. Perpetual Clone: using a hot-spare to clone	
	the drive reporting SMART errors; the hot-	
	spare remains a clone drive	
	3. Clone + Replace: using a hot-spare to replace	
	the drive reporting SMART errors; the drive	
	reporting errors is pulled offline	

A.6 Redundant Controller:

Active-active	Supported
redundant controller	

Synchronized cache	Supported. Through one or multiple, dedicated synchronizing channels on a common backplane or external cabling. Synchronized cache over SCSI channels, Fibre loops, or SATA channels is supported.
	Synchronized cache can be disabled via a UI option when using write-through mode in a redundant controller configuration to prevent performance trade-offs.
Write-back cache	Yes, with synchronized cache connection and
enabled in redundant controller mode	mirrored cache between controllers.
Automatic failover	Yes (user's interaction necessary; e.g., to restart the software management console)
Automatic failback	Yes (user's interaction necessary)
Controller hot-swap	 f No need to shut down the failed controller before replacing the failed controller. f Support online hot-swap of the failed controller. There is no need to reset or shutdown the failed controller. One controller can be pulled out during active I/Os to simulate the destructive controller failure.
Parity synchronization in redundant controller write-back mode to avoid write-hole	Supported.
Redundant controller communication over	Dedicated loops or distribution over drive loops selectable. Preset SATA paths or SAS domains
Fibre loops	on Falcon III / Magellan / X4 subsystems.
No single-point-of- failure	Supported.
Automatic engagement of replacement controller	Supported.
Dynamic cache memory allocation	Yes. Cache memory is dynamically allocated, not fixed.
Environment management	Supported. SAF-TE, S.E.S., ISEMS (I ² C interface), or S.E.S. over SAS links; and on-board controller voltage/temp monitor are all supported in both single and redundant controller mode. In the event of controller failure, services can be taken over by the surviving controller.
Cache battery backup	Supported. Battery backup modules support cached data during a power outage in both single controller and redundant controller modes.
	With EEPROM battery modules, firmware will be aware of the life expectancy of battery cells. This feature is supported since ASIC400 models.

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Load sharing	Supported. Workload can be flexibly divided between different controllers by assigning logical configurations of drives (LDs/LVs) to different RAID controllers.
User configurable channel mode	Supported. Channel modes configurable (SCSI or Fibre) as HOST or DRIVE on specific models such as the EonRAID 2510FS and Falcon III / Magellan / X4 F16F.
Require a special firmware for redundant controller?	No.

A.7 Data Safety:

Regenerate parity of logical drives	Supported. Can be manually executed to ensure that bad sectors do not cause data loss in the event of drive failure.
Scheduled Media Scan	Revision 3.34 and above allows Media Scan to be scheduled starting at a specified start time and repeated at regularly timed intervals. The start time and time intervals can be selected from drop-down menus. Start time is manually entered using its numeric representatives in the following order [MMDDhhmm[YYYY]], and it reads the date and time set for the controller's real-time clock.
	The selectable time intervals (the Execution Period) range from one (1) second to seven (7) weeks.
	Each such schedule can be defined to operate on individual hard drives, all members of a specified logical drive, or members of selected logical drives. Each schedule can include up to five (5) logical drives. The RS-232C terminal interface and RAIDWatch revision 2.0 support this functionality.
Bad block auto- reassignment	Supported. Automatic reassignment of bad block
Battery backup for cache memory	Supported. The battery backup unit supports cache memory when power failure occurs. The unwritten data in the cache memory can be committed to drive media when power is restored.
Verification on normal writes	Supported. Performs read-after-write during normal write processes to ensure data is properly written to drives.
Verification on rebuild writes	Supported. Performs read-after-write during rebuild write to ensure data is properly written to drives.
Verification on LD	Supported. Performs read-after-write during

initialization writes	logical drive initialization to ensure data is properly written to drives.
Drive S.M.A.R.T. support	Supported. Drive failure is predictable with reference to the different variables detected. Reaction schemes are selectable from Detect only, Perpetual Clone and Copy + Replace. These options help to improve MTBF.
Clone failing drive	Users may choose to clone data from a failing drive to a backup drive manually.
Automatic shutdown on over-temperature condition	Controller automatically enters an idle state (stops answering I/O requests) upon the detection of high-ambient temperature for an extended period of time.

A.8 System Security:

Password protection	Supported. All configuration changes require the correct password (if set) to ensure system security.
	Password protection is also bundled with all user interfaces.
User-configurable password validation timeout	Supported. After certain time in absence of user interaction, the password will be requested again. This helps to avoid unauthorized operation when user is away.
SSL-enabled RAIDWatch Agents	Agents communicate to the controller through limited set of authorization options.

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A.9 Environment Management:

SAF-TE/S.E.S. support	Supported. The SAF-TE/S.E.S. modules can be connected to the drive channels. The RAID controller will detect errors from SAF-TE/S.E.S. devices or notify drive failures via SAF-TE/S.E.S. Both SAF-TE/S.E.S. via drive and device-self-interfaced methods are supported. Redundant SAF-TE/S.E.S. devices are supported. Multiple S.E.S. devices are supported.
Dynamic on-lining of enclosure services	Once an expansion unit (JBOD) with supported monitoring interface is combined with a RAID system, its status will be automatically polled.
SAF-TE/S.E.S. polling period	User configurable (50ms, 100ms, 200ms, 500ms, 1~60sec)
ISEMS (RAID, Inc. Simple Enclosure Management Service)	Supported via an I2C serial bus.
Multiple SAF-TE/S.E.S. modules on the same channel	Supported.
Multiple SAF-TE /S.E.S. modules on different channels	Supported.
Mapping SAF-TE/S.E.S. device to host channel for use with host-based SAF-TE/S.E.S. monitoring	Supported.
Event Triggered Operation	When any of the following happens, the firmware disables write-back caching to minimize the chance of losing data: - Battery, controller, cooling fan, or PSU failure - The upper temperature thresholds are exceeded - Low battery charge - UPS AC loss or low battery charge The triggering factors are user-configurable
Dual-speed cooling fan control	Yes, firmware triggers high rotation speed in the event of elevated temperature or component failure, e.g., a fan failure.
Dual-LED drive status indicators	Supported. Both single-LED and dual-LED drive status indicators are supported.
SAF-TE/ S.E.S. temperature value display	Supported. Display the temperature value provided by enclosure SAF-TE/S.E.S. module (if available).
On-board controller	Supported. Monitors the 3.3V, 5V, and 12V

voltage monitors	voltage status. Event triggered thresholds user configurable.
On-board controller temperature sensors	Supported. Monitors the CPU and board temperature status. Event trigger threshold user configurable.
Enclosure redundant power supply status monitoring	Supported. SAF-TE/S.E.S./ISEMS
Enclosure fan status monitoring	Supported. SAF-TE/S.E.S/ISEMS
Enclosure UPS status monitoring	Supported. SAF-TE/S.E.S/ISEMS
Enclosure temperature monitoring	Supported. SAF-TE/S.E.S/ISEMS

A.10 User Interface:

RAIDWatch on-board	Out-of-band configuration and monitoring via Ethernet. Browser accessible configuration options by installing RAIDWatch to reserved space on drive via ftp. FW 3.48 and later revisions support a browser-invoked, http-based RAIDWatch GUI that requires no installation efforts.
RS-232C terminal	Supports terminal modes: ANSI, VT-100, ANSI Color. Provides menu-driven user-friendly text-based interface.
Graphical user interface (Java-based GUI manager)	Provides user-friendly graphical interface. Communicates with RAID controller via Out- of-band Ethernet, In-band SCSI, In-band Fibre or SNMP traps.
SSH support	Secure Shell over Telnet supported
External interface API for customized host-based management	Supported.
LCD front panel	Provides easy access for user instinct operation.
Buzzer alarm	Warns users when any failures or critical events occur.

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A.11 High Availability:

Custom inquiry serial number	Custom Inquiry Serial Number (for support of multi-pathing software like Veritas, QLogic, etc).
Asymmetric Logical Unit	Support for multipath drivers to select an
Access (or later known as	optimal I/O path and for more flexible
Target Port Group	utilization of internal I/O paths in the event of
Service)	path failure or controller failover/failback.

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B

System Functions: Upgrading Firmware

B.1 Upgrading Firmware

The RAID controller's firmware resides in flash memory that can be updated through the COM port, LAN port, or via In-band SCSI/Fibre. New releases of firmware are available in the form of a zip file on RAID's support site. The file available on the support site is usually a self-extracting file that contains the following:

FW30Dxyz Firmware Binary (where "xyz" refers to the firmware version)

B30Buvw Boot Record Binary (where "uvw" refers to the boot record version)

README.TXT Read this file first before upgrading the firmware/boot record. It contains the most upto-date information which is very important to the firmware upgrade and usage.

These files must be extracted from the compressed file and copied to a directory in boot drive.

B.1.1 Background RS-232C Firmware Download: Single Controller

Host I/Os will not be interrupted during the download process. After the download process is completed, user should find a chance to reset the controller for the new firmware to take effect.

B.1.2 Note for Redundant Controller Firmware Upgrade:

A controller used to replace a failed unit in a dual-controller system is often running a newer release of firmware version. To solve the contention, make sure the firmware on a replacement controller is downgraded to that running on the surviving controller.



MPORTANT!

- Allow the downloading process to finish. Do not reset or turn off the computer or the controller while it is downloading the file. Doing so may result in an unrecoverable error that requires the service of the manufacturer.
- When upgrading the firmware, check the boot record version that comes with it. If the boot record version is different from the one installed on the surviving controller previously, the new boot record binary must be installed.



The COM 2 serial port cannot be used to download firmware.

B.2 Upgrading Firmware Using RAIDWatch Manager

B.2.1 Establish the In-band SCSI connection in **RAIDWatch Manager**

Please refer to RAIDWatch User's Manual for details on establishing the management session for RAIDWatch Manager.

B.2.2 Upgrade Both Boot Record and Firmware Binaries

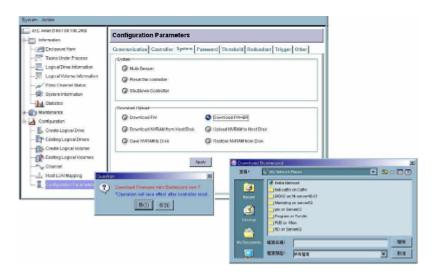


Figure B - 1: Upgrading Boot Record and Firmware Binaries Using RAIDWatch Program

- 1. Connect to the RAID system locally or from a remote computer using RAIDWatch Manager. While connected to the RAID system, there will be icon(s) with IP address specified on the left of the menu screen. Select by double-clicking the icon of the RAID system which firmware is to be upgraded. Select the "Configuration Parameters" icon and then select the "System" tab. Single-click the "Download FW+BR" check circle. Click the Apply button to proceed. A message prompt should display. Click Yes and then a file location prompt will appear.
- **2.** Provide the boot record binary filename, the RAIDWatch Manager will start to download the boot record binary to the controller.
- **3.** After the boot record download is completed, provide the firmware filename to the RAIDWatch Manager. It will start to download the firmware to RAID controller.
- **4.** Shutdown the application server(s) or stop the application(s) which are accessing the RAID, then reset the RAID subsystem/controller in order to use the new downloaded firmware. With firmware release 3.21 and above, host I/Os will not be interrupted by the download process. Users may find a chance to stop host I/Os and reset the controller for new firmware to take effect.

B.2.3 Upgrade the Firmware Binary Only



Figure B - 2: Upgrading Firmware Binaries Using RAIDWatch Program

- 1. Connect to the RAID system locally or from a remote computer using RAIDWatch Manager. While connected to the RAID system, there will be icon(s) with IP address specified on the left of the menu screen. Select by double-clicking the icon of the RAID subsystem which firmware is to be upgraded. Select the "Configuration Parameters" icon and then select the "System" tab. Single-click the "Download FW" check circle. Click the Apply button to proceed. A message prompt should display. Click Yes and then a file location prompt will appear.
- **2.** Provide the firmware filename to the RAIDWatch Manager. It will start to download the firmware to RAID controller.
- **3.** Shutdown the application server(s) or application(s) which are accessing the RAID, then reset the controller in order to use the new downloaded firmware.

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B.3 Upgrading Firmware Using RS-232C Terminal Emulation

The firmware can be downloaded to the RAID controller/subsystem by using an ANSI/VT-100 compatible terminal emulation program. Whichever terminal emulation program is used must support the ZMODEM file transfer protocol. The following example uses the HyperTerminal in Windows NT®. Other terminal emulation programs (e.g., Telix and PROCOMM Plus) can perform the firmware upgrade as well.

B.3.1 Establishing the connection for the RS-232C Terminal Emulation

Please refer to *Chapter 4*, "Connecting to Terminal Emulation," and also your hardware manual for details on establishing the connection.

B.3.2 Upgrading Both Boot Record and Firmware Binaries

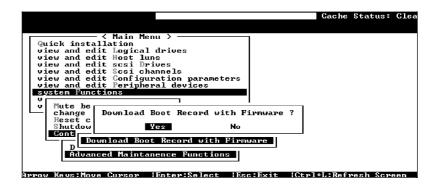


Figure B - 3: Upgrading Boot Record and Firmware Binaries Using Hyper Terminal Screen

- 1. From the Main Menu, scroll down to "System Functions."
- 2. Go to "Controller Maintenance."
- 3. Choose "Advanced Maintenance."
- 4. Select "Download Boot Record and Firmware."
- **5.** Set ZMODEM as the file transfer protocol of your terminal emulation software.

- **6.** Send the Boot Record Binary to the controller. In HyperTerminal, go to the "Transfer" menu and choose "Send file." If you are not using Hyper Terminal, choose "Upload" or "Send" (depending on the software).
- 7. After the Boot Record has been downloaded, send the Firmware Binary to the controller. In HyperTerminal, go to the "Transfer" menu and choose "Send file." If you are not using Hyper Terminal, choose "Upload" or "Send" (depending on the software).
- **8.** When the Firmware completes downloading, the controller will automatically reset itself. For a newer version of firmware, you need to manually reset the subsystem/controller for the new firmware to take effect.

B.3.3 Upgrading the Firmware Binary Only



Figure B - 4: Upgrading Firmware Binaries Using Hyper Terminal Screen

- 1. From the Main Menu, scroll down to "System Functions."
- 2. Go to "Controller Maintenance."
- 3. Choose "Download Firmware."
- **4.** Set ZMODEM as the file transfer protocol of your terminal emulation software.
- **5.** Send the Firmware Binary to the controller. In Hyper Terminal, select "Send file." If you are not using Hyper Terminal, choose "Upload" or "Send" (depending on the software).

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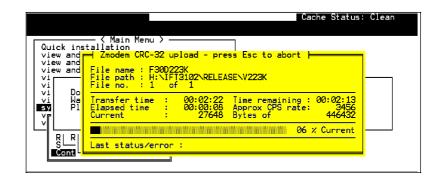


Figure B - 5: Sending Files

6. When the Firmware completes downloading, the controller will automatically reset itself. If the subsystem/controller is running firmware later than version 3.21, you need to manually reset the subsystem/controller for the new firmware to take effect.

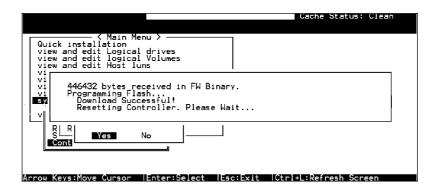


Figure B - 6: Receiving Firmware Files

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C

Event Messages

The controller events can be categorized as follows according to the severity levels:

Critical Errors that need to attend to immediately

Warning Errors

Notification Command processed message sent from Firmware The RAID subsystem records all system events from power on, temporarily record them in cache with up to 1,000 entries. To power off or to reset the controller will cause an automatic deletion of all the recorded event logs.

The RAIDWatch manager can be used to record events on multiple subsystems especially when controller reset or power-off is an expected action. The events can also be seen from RAIDWatch's Configuration Client utility. Associated details can be found in the RAIDWatch user's manual and online help.

Descriptions below may contain abbreviations. Abbreviations and Capitalized letters are preserved for the coherency with the event messages shown on the terminal session.

C.1 Logical Drive Events

C.1.1 Critical:

LG:0 Logical Drive ALERT: CHL:0 ID:132 Drive Missing

LG:0 Logical Drive ALERT: CHL:0 ID:132 Drive Failure

LG:0 Logical Drive ALERT: Rebuild Aborted LG:0 Logical Drive ALERT: Rebuild Failed

LG:0 Logical Drive ALERT: Parity Regeneration Aborted

LG:0 Logical Drive ALERT: Parity Regeneration Failed

LG:0 Logical Drive ALERT: Creation Aborted LG:0 Logical Drive ALERT: Creation Failed

LG:0 Logical Drive ALERT: Initialization Failed

LG:0 Logical Drive ALERT: Expansion Aborted

LG:0 Logical Drive ALERT: Expansion Failed

ALERT: CHL:0 ID:132 Media Scan Failed

LG:0 ALERT: CHL:0 ID:132 Media Scan Failed

LG:0 Logical Drive ALERT:CHL:0 ID:132 Clone Failed

LG:0 Logical Drive ALERT:CHL:0 ID:132 Clone Aborted

LG:0 Logical Drive ALERT:CHL:0 ID:132 Clone Failed

LG:0 Logical Drive ALERT:CHL:0 ID:132 Clone Aborted

LG:0 Logical Drive ALERT: Logical Drive Bad Block Table FULL

LG:0 Logical Drive ALERT: Logical Drive Bad Block Table BAD

LG:0 Logical Drive ALERT: Logical Drive On-Line Init Table BAD

LG:0 Logical Drive ALERT: Bad Data Block Marked 000000084

LG:0 Logical Drive ALERT: UNPROTECTED Block Marked 000000084

LG:0 Logical Drive NOTIFY: Bad Data Block Encountered 000000084

LG:0 ALERT: Inconsistent Parity Encountered Block 20000000B

C.1.2 Notification:

LG:0 Logical Drive NOTICE: Continue Rebuild Operation

LG:0 Logical Drive NOTICE: Starting Rebuild

LG:0 Logical Drive NOTICE: Rebuild of Logical Drive Completed

LG:0 Logical Drive NOTICE: Continue Parity Regeneration Operation

LG:0 Logical Drive NOTICE: Starting Parity Regeneration

LG:0 Logical Drive NOTICE: Parity Regeneration of Logical Drive Completed

LG:0 Logical Drive NOTICE: Starting Creation

LG:0 Logical Drive NOTICE: Creation of Logical Drive Completed

LG:0 Logical Drive NOTICE: Starting On-Line Initialization

LG:0 Logical Drive NOTICE: On-Line Initialization of Logical Drive Completed

LG:0 Logical Drive NOTICE: Starting Off-Line Initialization

LG:0 Logical Drive NOTICE: Off-Line Initialization of Logical Drive Completed

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LG:0 Logical Drive NOTICE: Starting On-Line Expansion

LG:0 Logical Drive NOTICE: On-Line Expansion of Logical Drive Completed

LG:0 Logical Drive NOTICE: Starting Off-Line Expansion

LG:0 Logical Drive NOTICE: Off-Line Expansion of Logical Drive Completed

LG:0 Logical Drive NOTICE: Continue Add Drive Operation

LG:0 Logical Drive NOTICE: Starting Add Drive Operation

LG:0 Logical Drive NOTICE: Add Drive Operation Paused

LG:0 Logical Drive NOTICE: Add Drive to Logical Drive Completed

LG:0 Logical Drive NOTICE: Add Drive Operation Paused

NOTICE: CHL:0 ID:132 Starting Media Scan

LG:0 NOTICE: CHL:0 ID:132 Starting Media Scan

NOTICE: Media Scan of CHL:0 ID:132 Completed

LG:0 NOTICE: Media Scan of CHL:0 ID:132 Completed

LG:0 ALERT: CHL:0 ID:132 Media Scan Aborted

LG:0 Logical Drive NOTICE:CHL:0 ID:132 Continue Clone Operation

LG:0 Logical Drive NOTICE:CHL:0 ID:132 Starting Clone

LG:0 Logical Drive NOTICE:CHL:0 ID:132 Copy and Replace Completed

LG:0 Logical Drive NOTICE:CHL:0 ID:132 Clone Completed

LG:0 Logical Drive NOTIFY: Bad Data Block Recovered 000000084

LG:0 Logical Drive NOTIFY: Bad Data Block Recovered 000000084

C.2 Channel and Individual Drive Events

C.2.1 Critical:

CHL:0 ID:132 ALERT:Media Error Unrecoverable-0xD8001C7C CHL:0 FATAL ERROR(0)

C.2.2 Warning:

CHL:1 ID:0 Target ALERT: Unexpected Select Timeout CHL:1 ID:0 Target ALERT: Unexpected Select Timeout CHL:1 Drive Channel ALERT: Unexpected Select Timeout CHL:1 RCC Channel ALERT: Gross Phase/Signal Error Detected CHL:1 ID:0 Target ALERT: Gross Phase/Signal Error Detected CHL:1 ID:0 Target ALERT: Gross Phase/Signal Error Detected CHL:1 Drive Channel ALERT: Gross Phase/Signal Error Detected CHL:1 RCC Channel ALERT: Unexpected Disconnect Encountered CHL:1 ID:0 Target ALERT: Unexpected Disconnect Encountered CHL:1 ID:0 Target ALERT: Unexpected Disconnect Encountered CHL:1 Drive Channel ALERT: Unexpected Disconnect Encountered CHL:1 RCC Channel ALERT: Timeout Waiting for I/O to Complete CHL:1 ID:0 Target ALERT: Timeout Waiting for I/O to Complete CHL:1 ID:0 Target ALERT: Timeout Waiting for I/O to Complete CHL:1 Drive Channel ALERT: Timeout Waiting for I/O to Complete CHL:1 RCC Channel ALERT: Parity/CRC Error Detected CHL:1 ID:1 Host Channel ALERT: Parity/CRC Error Detected CHL:1 Host Channel ALERT: Parity/CRC Error Detected CHL:0 ID:0 Drive ALERT: Unexpected Drive Not Ready (00B) CHL:0 ID:0 Drive ALERT: Drive HW Error (00B) CHL:0 RCC Channel ALERT: Unit Attention Received CHL:0 ID:0 Target ALERT: Unit Attention Received (10B) CHL:0 ID:0 Target ALERT: Unit Attention Received CHL:0 Drive Channel ALERT: Unit Attention Received CHL:0 ID:0 Drive ALERT: Aborted Command (00B) CHL:0 ID:0 Drive ALERT: Unexpected Sense Received (00B) CHL:0 ID:0 Drive NOTIFY: Block Reassignment Failed - 0 (10B) CHL:0 ID:0 Drive NOTIFY: Block Reassignment Failed - 0x0 CHL:0 RCC Channel ALERT: Data Overrun/Underrun Detected CHL:0 ID:0 Target ALERT: Data Overrun/Underrun Detected CHL:0 ID:0 Target ALERT: Data Overrun/Underrun Detected CHL:0 Drive Channel ALERT: Data Overrun/Underrun Detected CHL:0 RCC Channel ALERT: Negotiation Error Detected CHL:0 ID:0 Target ALERT: Negotiation Error Detected CHL:0 ID:0 Target ALERT: Negotiation Error Detected CHL:0 Drive Channel ALERT: Negotiation Error Detected CHL:0 RCC Channel ALERT: Invalid Status/Sense Data Received CHL:0 ID:0 Target ALERT: Invalid Status/Sense Data Received (10B) CHL:0 ID:0 Target ALERT: Invalid Status/Sense Data Received CHL:0 Drive Channel ALERT: Invalid Status/Sense Data Received CHL:0 ALERT: Redundant Loop Connection Error Detected on ID:11

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CHL:0 Host Channel ALERT: Channel Failure

SMART-Slot:-1 Predictable Failure Detected-Clone Failed

SMART-Slot:-1 Predictable Failure Detected

SMART-Slot:-1 Predictable Failure Detected-Starting Clone

SMART-Slot:-1 Predictable Failure Detected(TEST)

SMART-Slot:-1 Predictable Failure Detected(TEST)

SMART-Slot:-1 Predictable Failure Detected(TEST)

SMART-Slot:-1 Predictable Failure Detected(TEST)

CHL:0 ALERT: Fibre Channel Loop Failure Detected

CHL:0 ALERT:Redundant Loop for Chl:0 Failure Detected

CHL:0 ALERT:Redundant Path for Chl:0 ID:0 Expected but Not Found

CHL:0 ID:0 ALERT:Redundant Path for Chl:0 ID:0 Failure Detected

C.2.3 Notification:

CHL:0 ID:132 NOTICE:Media Error Recovered-0xD8001C7C

CHL:0 ID:132 NOTICE:Media Error Recovered-0xD8001C7C

CHL:0 NOTICE:Fibre Channel Loop Connection Restored

CHL:0 ID:255 NOTICE:Redundant Path for Chl:0 Restored

CHL:0 NOTICE:Redundant Path for Chl:0 ID:0 Restored

CHL:0 ID:0 NOTICE:Redundant Path for Chl:0 ID:0 Restored

CHL:0 ID:0 Drive NOTICE: Drive Recovered Error Reported

CHL:0 LIP(FF B) Detected

CHL:0 Host Channel Notification: Bus Reset Issued

CHL:0 Host Channel ALERT: Bus Reset Issued

CHL:0 ID:0 Drive NOTICE: Scan Drive Successful

CHL:0 ID:0 Drive NOTIFY: Block Successfully Reassigned - 0 (10B)

CHL:0 ID:0 Drive NOTIFY: Block Successfully Reassigned - 0x0

C.3 General Target Events

C.3.1 Critical:

SAF-TE Device(0)ALERT: Power Supply Failure Detected(Idx:132)

Peripheral Set 0 Device ALERT:Power Supply 0 Failure Detected

Peripheral Set 0 Device ALERT:Power Supply 0 Not Present

Peripheral Set 0 Device ALERT: Low Voltage Detected(-1073939240.5V)

SES(C0 I0)Power Supply 0:Device Not Supported!

SAF-TE Device(0)ALERT: Cooling Fan Not Installed(Idx:2)

SAF-TE Device(0)ALERT: Cooling Fan Failure Detected(Idx:2)

Peripheral Set 0 Device ALERT: Cooling fan2 Failure Detected

Peripheral Set 0 Device ALERT: Cooling fan2 Not Present

Peripheral Set 0 Device ALERT: Low Speed Detected (-1073870808 RPM)

SES(C0 I0)Cooling Fan 0:Device Not Supported!

SAF-TE Device(0)ALERT: Elevated Temperature Alert

Peripheral Device ALERT: CPU Cold Temperature Detected(0.0(C))

Peripheral Device ALERT: Elevated Temperature Alert

Peripheral Device ALERT: Elevated Temperature Alert

Peripheral Set 0 Device ALERT: Temperature Sensor 0 Failure Detected

Peripheral Set 0 Device ALERT: Temperature Sensor 0 Not Present

Peripheral Set 0 Device ALERT: Cold Detected(0(C))

SES(C0 I0)Temp Sensor 0:Device Not Supported!

UPS Connection Is Absent

SAF-TE Device(2)ALERT: UPS Power Failure Detected

Peripheral Set 2 Device ALERT: UPS 2 AC Power Failure Detected

Peripheral Set 2 Device ALERT: UPS 2 Battery Failure Detected

Warning: UPS AC Power-Loss Detected

Warning: UPS Battery Low - 0%.

SES(C0 I0)UPS 2: Device Not Supported!

C.3.2 Notification:

SAF-TE Device(2) NOTICE: Fan Back On-Line(Idx:11)

NOTICE: FAN Module A Back On-Line(FAN0 0RPM)

NOTICE: Controller FAN 1 Back On-Line(0 RPM)

Peripheral Device NOTICE: Fan Back On-Line

Peripheral Set 1 Device NOTICE: FAN 1 Back On-Line

Peripheral Set 1 Device NOTICE: FAN 1 is Present

Peripheral Set 1 Device NOTICE: FAN 1 Back On-Line(0 RPM)

SES(C0 I0)Cooling Fan 1:Fan Back On-Line

SAF-TE Device(1) NOTICE: Temperature Back To Non-Critical LVs

Peripheral Set 1 Device NOTICE: Temperature 1 Back To Non-Critical LVs

Peripheral Set 1 Device NOTICE: Temperature 1 is Present

Peripheral Set 1 Device NOTICE: Temperature 1 Back To Non-Critical LVs(0(C))

SES(C0 I0)Temp Sensor 1:Temperature Back To Non-Critical LVs

SAF-TE Device(1) NOTICE: Power Supply Back On-Line(Idx:4)

Power Supply 0 Back-Online

Peripheral Set 2 Device NOTICE: PSU0 +12V Back On-Line

Peripheral Set 2 Device NOTICE: PSU0 +12V is Present

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Peripheral Set 2 Device NOTICE: PSU0 +12V Back On-Line(5.0V)

SES(C0 I0)Power Supply 2:Power Supply Back On-Line

UPS Connection Detected UPS AC Power Restored

UPS Battery Restored To Safe Level 0

SAF-TE Device(2) NOTICE: UPS Power Back On-Line

Peripheral Set 2 Device NOTICE: UPS 2 AC Power Back On-Line Peripheral Set 2 Device NOTICE: UPS 2 Battery Back On-Line

SES(C0 I0)UPS 2:UPS Power Back On-Line

C.4 Controller Events

C.4.1 Critical:

ALERT: +3.3V Low Voltage Detected(205.9V)

ALERT: Controller FAN 0 Low Speed Detected(0 RPM)
Controller NOTICE: Redundant Controller Firmware Updated
Controller ALERT: Redundant Controller Failure Detected

Controller SDRAM ECC Multi-bits Error Detected Controller SDRAM ECC Single-bit Error Detected

Controller SDRAM Parity Error Detected Controller PCI Bus Parity Error Detected

Controller ALERT: Power Supply Unstable or NVRAM Failed BBU Absent or Failed!Correct It and Reset Ctlr to Take Effect

Controller BBU Absent or Failed!! Controller BBU Failure Detected!

Controller BBU Thermal Shutdown/Enter Sleep-Mode!

C.4.2 Warning:

Memory Not Sufficient to Fully Support Current Config.

C.4.3 Notification:

Board1 Cold Temperature Back To Non-Critical LVs(0(C))

+12V Upper Voltage Back within Acceptable Limits(0.0V)

+12V Lower Voltage Back within Acceptable Limits(0.0V)

Memory is Now Sufficient to Fully Support Current Config.

Controller NOTICE: NVRAM Factory Defaults Restored

Controller NOTICE: NVRAM Factory Defaults Restored

Controller NOTICE: NVRAM Factory Defaults Restored

Controller BBU is Charging!
NOTICE: Controller BBU Present!

NOTICE: Controller BBU Back On-Line!

NOTICE: Controller BBU Fully Charged!

Force Controller Write-Through on Trigger Cause

C.5 Logical Drive Events

C.5.1 Critical:

Message	LG:0 Logical Drive ALERT: CHL:0 ID:132 Drive Missing
What Happens?	The specified hard drive in the specified logical drive has is missing.
What to Do?	The drive could have been accidentally removed or drive
	connection problems occurred. Check drive connection and related enclosure status.
Message	LG: Logical Drive ALERT: CHL:0 ID:132 Drive Failure
What Happens?	The specified hard drive in the specified logical drive has failed
What to Do?	IF a spare is available, the subsystem will automatically start
	rebuild. If there is no spare, replace the faulty drive and rebuild
	will be automatically initiated provided that a replacement drive
	can be recognized by the subsystem. For example, in a SCSI-based
	subsystem, a manual "Scan Drive" command should be executed.
	In subsystems using other types of disk drives, drive swap
	auto-detection should be enabled on the drive channels.
Message	LG:0 Logical Drive ALERT: Rebuild Aborted
What Happens?	Logical drive rebuild aborted. It could result from the one of the
ттат паррене	following reasons:
	1. The rebuild has been manually canceled by a user.
	2. The replacement drive used for a rebuild may have failed
	during the rebuild or the drive contains immanent defects.
	3. Bad blocks are encountered on another member drive
	during the rebuild. (RAID 1, 3, and 5 arrays)
	System faults occurred.
What to Do?	Carefully identify and replace the faulty drive and perform logical
	drive rebuild again. It is best to stop host I/Os temporarily to this
	logical drive.

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Message	LG:0 Logical Drive ALERT: Rebuild Failed
What Happens?	Logical drive rebuild failed. It could result from the one of the
	following reasons:
	1. The rebuild has been manually canceled by a user.
	2. The replacement drive used for a rebuild may have failed
	during the rebuild or the drive contains immanent defects.
	3. Bad blocks are encountered on another member drive
	during the rebuild. (RAID 1, 3, and 5 arrays)
	4. System faults occurred.
What to Do?	Carefully identify and replace the faulty drive and perform logical
	drive rebuild again. It is best to stop host I/Os temporarily to this
	logical drive.
Message	LG:0 Logical Drive ALERT: Parity Regeneration Aborted
What Happens	3 3 1
	operation. Irrecoverable parity inconsistency may also cause a halt
	to the operation.
What to Do?	Check proper system working conditions. Contact system vendor
	for help.
Message	LG:0 Logical Drive ALERT: Parity Regeneration Failed
What Happens	
	operation. Irrecoverable parity inconsistency may also cause a halt
	to the operation.
What to Do?	Check proper system working conditions. Contact system vendor
	for help.
Message	LG:0 Logical Drive ALERT: Creation Aborted
What Happens?	Logical drive creation process manually aborted or that some
	system integrity problems forced the subsystem to abort logical
	drive creation process.
What to Do?	Check proper system working conditions.
Message	LG:0 Logical Drive ALERT: Creation Failed
What Happens?	Logical drive creation process failed when one or more drive
	members failed or have been accidentally removed. Drive
_	abnormality may also be the cause of the problems.
What to Do?	Check proper system working conditions and drive connection.
	Replace the faulty drives and repeat the creation process.

Message	LG:0 Logical Drive ALERT: Initialization Failed
What Happens?	Logical drive initialization failed. It could result from one of the
	following reasons:
	1. One of the disk drives used for a logical drive might have
	failed during rebuild.
	2. Media errors are encountered on another member drive
	during the initialization process.
	3. Drive hardware faults occurred.
What to Do?	Carefully identify and replace the faulty drive and perform logical
What to Bot	drive initialization again.
	di ive ilittanzation again.
	LCAL agical Drive ALEDT, Eupanaian Abartad
Message	LG:0 Logical Drive ALERT: Expansion Aborted
What Happens?	Logical drive expansion failed. It could result from one of the
	following reasons:
	 The expansion has been canceled by a user.
	2. The drive used for expansion might have failed during
	expansion.
	3. Media errors are encountered on another member drive
	during the expansion process.
	4. One member drive has failed.
	5. Drive hardware faults occurred.
What to Do?	Carefully identify and replace the faulty drive and perform logical
	drive expansion again.
	-
Message	LG:0 Logical Drive ALERT: Expansion Failed
Message What Happens?	LG:0 Logical Drive ALERT: Expansion Failed Logical drive initialization failed. It could result from one of the
Message What Happens?	Logical drive initialization failed. It could result from one of the
	Logical drive initialization failed. It could result from one of the following reasons:
	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during
	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion.
	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive
	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process.
	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed.
What Happens?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred.
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What Happens?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred.
What Happens? What to Do?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again.
What Happens? What to Do? Message	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed
What Happens? What to Do?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain
What Happens? What to Do? Message	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically
What Happens? What to Do? Message What Happens?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed.
What Happens? What to Do? Message	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed. Carefully identify and replace the faulty drive if rebuild is
What Happens? What to Do? Message What Happens?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed.
What Happens? What to Do? Message What Happens?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed. Carefully identify and replace the faulty drive if rebuild is
What Happens? What to Do? Message What Happens?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed. Carefully identify and replace the faulty drive if rebuild is
What Happens? What to Do? Message What Happens? What to Do?	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed. Carefully identify and replace the faulty drive if rebuild is possible.
What to Do? Message What Happens? What to Do? Message	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed. Carefully identify and replace the faulty drive if rebuild is possible. LG:0 ALERT: CHL:0 ID:132 Media Scan Aborted Media Scan operation is aborted for certain reasons, e.g., it has
What to Do? Message What Happens? What to Do? Message	Logical drive initialization failed. It could result from one of the following reasons: 1. The drive(s) used for expansion might have failed during expansion. 2. Media errors are encountered on another member drive during the expansion process. 3. One member drive has failed. 4. Drive hardware faults occurred. Carefully identify and replace the faulty drive and perform logical drive expansion again. LG:0 ALERT: CHL:0 ID:132 Media Scan Failed Media Scan failed to carry on with scanning drive(s) for certain reasons, e.g., a logical drive or a disk drive has fatally or physically failed. Carefully identify and replace the faulty drive if rebuild is possible. LG:0 ALERT: CHL:0 ID:132 Media Scan Aborted

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Massaga	LC.O.L. opical Drive ALEDT, CLIL O. ID:122 Clans Failed
Message	LG:0 Logical Drive ALERT: CHL:0 ID:132 Clone Failed
What Happens?	Drive cloning failed. It could result from one of the following
	reasons:
	1. Cloning has been manually canceled by a user.
	2. The drive used for cloning might have failed during the
	cloning process. 3. Bad blocks are encountered on another member drive
	during the cloning process.
	4. The source drive has failed.
	5. System faults occurred.
What to Do?	-
vvnat to Do?	Carefully identify and replace the faulty drive.
Message	LG:0 Logical Drive ALERT: CHL:0 ID:132 Clone Aborted
What Happens?	Logical drive cloning aborted. It could result from one of the
	following reasons:
	1. The cloning process has been manually canceled by a user.
	2. The drive used for cloning might have failed during
	cloning.
	3. Media errors are encountered on another member drive
	during the cloning process.
	4. The source drive has failed.
	5. System has been reset or drive hardware faults occurred.
What to Do?	Carefully identify and replace the faulty drive.
Message	LG:0 Logical Drive ALERT: Logical Drive Bad Block Table FULL
What Happens?	Available bad block table entries full. Media Scan or host access
	has discovered and marked too many damaged sectors.
What to Do?	The target disk drive may have become physically unreliable.
	Contact system vendor for help.
Message	LG:0 Logical Drive ALERT: Logical Drive Bad Block Table BAD
What Happens?	System failed to generate a bad block table. Logical drive may
vviiat i iappeiis!	have generated serious integrity problems.
What to Do?	The members of a logical drive may have become physically
vviiat to Do:	unreliable. Locate, replace, and replace the logical drive if
	possible. Contact system vendor for help.
	possible. Contact system vendor for help.
Message	LG:0 Logical Drive ALERT: Logical Drive On-Line Init Table Bad
What Happens?	Serious system faults might have occurred, unstable voltage or
	damaged components, and forced the initialization to halt.
What to Do?	Check proper system working conditions. Contact system vendor
	for help.

Message	LG:0 Logical Drive ALERT: Bad Data Block Marked 000000084
What Happens?	Media errors caused data inconsistency; e.g., concurrent
	occurrences of media errors on more than one RAID5 member
	drive. The affected data blocks # are marked bad. The situation
	may result from the following:
	 One member drive failed, and media errors are found on another member drive.
	Media errors occurred consequentially on two member
	drives.
What to Do?	The data affected by data blocks failure will be lost. The host
	computer will return media error messages if host accesses fall
	within the affected blocks.
Message	LG:0 Logical Drive ALERT: UNPROTECTED Block Marked 000000084
What Happens?	Media errors are found in an unprotected array, e.g., RAID0. The affected data blocks will be marked bad.
What to Do?	The data affected by data blocks failure will be lost. The host computer will return media error messages if host access falls ithin the affected blocks. Restoring data from a backup source is recommended.
Message	LG:0 Logical Drive NOTIFY: Bad Data Block encountered 000000084
What Happens?	Data blocks previously marked bad are re-encountered during host I/O access or certain operations such as Media Scan.
What to Do?	The data affected by data blocks failure is lost. Restoring data from
	a backup source is recommended. The host computer will return
	media error messages if host access falls within the affected blocks.
Message	LG:0 ALERT: Inconsistent Parity Encountered Block 000000084
What Happens?	Parity inconsistency encountered on block address
What to Do?	It is recommended to perform the "Regenerate Parity" function to
	correct the parity faults.

C.5.2 Notification:

Message	LG:0 Logical Drive NOTICE: Continue Rebuild Operation
What Happens?	The target logical drive has been stored to its previous one-drive-failed status, and the rebuild operation is automatically resumed by firmware. This may occur when the system is powered off or reset during the rebuild process or that media errors have been discovered and corrected during the rebuild.
What to Do?	Press ESC to clear the message.
Message	LG:0 Logical Drive NOTICE: Starting Rebuild

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What Happens?	The rebuild process has begun.
What to Do?	This is the message displayed when a stand-by spare is available
	when a member drive fails or when a faulty drive is physically
	replaced. The subsystem should automatically detect a drive for
	rebuild if the hot-swap detection mechanism has been enabled.
Message	LG:0 Logical Drive NOTICE: Rebuild of Logical Drive Completed
What Happens?	The subsystem has successfully rebuilt a logical drive.
What to Do?	Press ESC to clear the message.
	V
Message	LG:0 Logical Drive NOTICE: Continue Parity Regeneration
Wiossago	Operation
What Happens?	Start
What to Do?	Press ESC to clear the message.
	J.
Message	LG:0 Logical Drive NOTICE: Starting Parity Regeneration
What Happens?	Start regenerating parity of a logical drive.
What to Do?	Press ESC to clear the message.
What to Bo.	11000 200 to 010ai tilo 111000agoi
Message	LG:0 Logical Drive NOTICE: Parity Regeneration of Logical Drive
Wicssage	Completed
What Happens?	The parity regeneration process on logical drive _ is completed.
What to Do?	Press ESC to clear the message.
What to Bo.	11000 E00 to diodi tilo illossago.
Message	LG:0 Logical Drive NOTICE: Starting Creation
What Happens?	Logical drive creation process started. Note that the creation and
what happens.	initialization processes are separated. Creation of a logical drive
	only takes a second while the initialization may take hours with
	the arrays containing large capacity drives.
What to Do?	Press ESC to clear the message.
What to Bo:	Tress 250 to cical the message.
Message	LG:0 Logical Drive NOTICE: Starting On-Line Initialization
What Happens?	Creation process is completed, initialization process has begun to
vviiat i iapperis:	generate parity sectors and readying member drives. The On-line
	initialization mode takes a longer time to complete and allows the
	logical drive to receive host I/Os immediately if appropriate host
\\/\batta	ID/LUN mapping has been applied.
What to Do?	Press ESC to clear the message.
Massags	LC.O.Logical Drive NOTICE, On Line Initialization of Legisch
Message	LG:0 Logical Drive NOTICE: On-Line Initialization of Logical
Mhat Hannana	Drive Completed
What to Do?	Logical drive on-line initialization completed
What to Do?	Press ESC to clear the message.

Message	LG:0 Logical Drive NOTICE: Starting Off-Line Initialization	

What Happens?	Creation process is completed, initialization process has begun to generate parity sectors and readying member drives. The Off-line initialization mode takes place immediately after the creation of a logical drive, and does not allow host I/Os to be distributed to the logical drive at the same time.
What to Do?	Press ESC to clear the message.
	v
Message	LG:0 Logical Drive NOTICE: Off-Line Initialization of Logical Drive Completed
What Happens?	Logical drive off-line initialization completed. The logical drive is now ready for host ID/LUN mapping, and then receiving host I/Os.
What to Do?	Press ESC to clear the message.
Message	LG:0 Logical Drive NOTICE: Starting On-Line Expansion
What Happens?	Start expanding the logical drive's added or free capacity (previously not included) when system find appropriate time after selecting to expand its capacity. The On-Line mode allows the added capacity of a logical drive to appear immediately as a usable partition and ready for host I/Os. This partition may require being associated with a separate ID/LUN on the host bus. Response to host I/Os will be slower because the expansion process requires distributing data blocks and parity data across new drive sectors.
What to Do?	
vviiat to Do:	Press ESC to clear the message.
Message	LG:0 Logical Drive NOTICE: On-Line Expansion of Logical Drive Completed
What Happens?	Logical drive on-line expansion completed. The added capacity will appear as a new partition, and this partition may require being associated with a separate ID/LUN on the host bus. Adjustments should also be made through the host OS volume management utility.
What to Do?	Press ESC to clear the message.
	<u> </u>
Message	LG:0 Logical Drive NOTICE: Starting Off-Line Expansion
What Happens?	Start expanding the logical drive's added or free capacity (previously not included) when system find appropriate time after selecting to expand its capacity. The Off-Line mode does not allow the added capacity of a logical drive to be immediately available for host I/Os. This partition can only be associated with a separate ID/LUN on the host bus after the expansion process is completed. Access to the data already stored on the logical drive is not affected.
What to Do?	Press ESC to clear the message.
vviidt to DO:	1 1 000 200 to clear the message.

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Massaga	LCOLogical Drive MOTICE: Continue Add Drive Operation
Message	LG:0 Logical Drive NOTICE: Continue Add Drive Operation
What Happens?	The target logical drive has been restored to its previous status,
	e.g., power-off or media errors, and the add drive operation can continue.
What to Do?	Press ESC to clear the message.
What to Bo.	Tress 250 to treal the message.
Message	LG:0 Logical Drive NOTICE: Starting Add Drive Operation
What Happens?	Add drive expansion process started
What to Do?	Press ESC to clear the message.
	-
Message	LG:0 Logical Drive NOTICE: Add Drive Operation Paused
What Happens?	The add drive expansion process is halted by:
	 Logical drive expansion is canceled by a user.
	2. One of the member drives failed during logical drive
	expansion.
	3. Media errors are found on one or more of the logical drive
	members.
	4. System faults have occurred.
What to Do?	Carefully identify and replace the faulty drive and correct system
	faults. The add drive expansion should continue once the faults are corrected.
	are corrected.
Message	LG:0 Logical Drive NOTICE: Add Drive to Logical Drive
Wicssage	Completed
What Happens?	The add drive expansion process is completed.
What to Do?	Press ESC to clear the message. Please remember to rearrange the
	added capacity which will appear as a new partition volume.
	· · · · · · · · · · · · · · · · · · ·
Message	NOTICE: CHL:0 ID:132 Starting Media Scan
What Happens?	Media Scan is manually or automatically started by the preset Task
	Schedules on a specific disk drive.
What to Do?	Press ESC to clear the message.
Message	LG:0 NOTICE: CHL:0 ID:132 Starting Media Scan
What Happens?	Media Scan is manually or automatically started by the preset Task
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	Schedules on a specific member of Logical Drive 0.
What to Do?	Press ESC to clear the message.
Mossago	MOTICE: Modia Scan of CUI in ID:122 Completed
Message What Happens?	NOTICE: Media Scan of CHL:0 ID:132 Completed Media Scan on a specific disk drive is completed.
	· · · · · · · · · · · · · · · · · · ·
What to Do?	Press ESC to clear the message.
Message	LG:0 NOTICE: Media Scan of CHL:0 ID:132 Completed
What Happens?	Media Scan on a specific member of Logical Drive 0 is completed.
What to Do?	Press ESC to clear the message.
Message	LG:0 Logical Drive NOTICE: CHL:0 ID:132 Continue Clone

	Operation
What Happens?	The target logical drive has been restored to its previous status,
	e.g., a failed drive is restored, and the cloning process can
	continue.
What to Do?	Press ESC to clear the message.
Message	LG:0 Logical Drive NOTICE: CHL:0 ID:132 Starting Clone
What Happens?	Cloning process started on one of the members of Logical Drive 0
What to Do?	Press ESC to clear the message.
Message	LG:0 Logical Drive NOTICE: CHL:0 ID:132 Copy and Replace
	Completed
What Happens?	Copy and replace is completed with a specific member of Logical
	Drive 0. The original member drive is replaced by another disk
	drive.
What to Do?	Press ESC to clear the message.
Message	LG:0 Logical Drive NOTICE: CHL:0 ID:132 Clone Completed
What Happens?	Cloning is completed with a specific member of Logical Drive 0,
	whether it is replaced (Copy and Replace) or cloned (Perpetual
	Clone) to a spare drive.
What to Do?	Press ESC to clear the message.
Message	LG:0 Logical Drive NOTIFY: Bad Data Block Recovered 000000084
What Happens?	Host writes fall onto the data blocks previously marked bad and
	overwrite the drive sectors.
What to Do?	Press ESC to clear the message.

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C.6 Channel and Individual Drive Events

C.6.1 Critical:

Message	CHL:0 ID:132 Target ALERT: Media Error Unrecoverable-0xD8001C7C
What Happens?	Drive surface media errors found and after rewrite the drive sectors are determined as physically damaged and unusable.
What to Do?	Data will be reassigned to other drive sectors. Host writes should continue without problems.
Message	CHL:0 Fatal Error (0)
What Happens?	Channel 0 has fatally failed.
What to Do?	Contact your system vendor for help.

C.6.2 Warning:

Message	CHL:1 ID:0 Target ALERT: Unexpected Select Timeout
What Happens?	Drive target select timeout. The specified hard drive cannot be
	selected by the RAID controller/subsystem. Whether the drive
	has been removed, or the cabling/termination/canister is out of
	order.
What to Do?	This could occur if a disk drive is not properly installed or
	accidentally removed, or when cable links become unreliable.
	Check cabling and drive installation, and contact your RAID
	system supplier.
Message	CHL:1 Drive Channel ALERT: Unexpected Select Timeout
What Happens?	Drive Channel target select timeout. The specified drive channel
	cannot be selected by the RAID controller/subsystem. Faults
	might have occurred with the cabling/termination/internal data
	paths.
What to Do?	Check cabling and drive installation, and contact your RAID
	system supplier.
Message	CHL:_RCC Channel ALERT: Gross Phase/Signal Error Detected
What Happens?	Phase/signal abnormality detected on the specific RCC channel.
What to Do?	Rare occurrence of phase/signal error could be recovered by
	firmware retry. Contact your RAID system supplier.
Message	CHL:_ID:_Target ALERT: Gross Phase/Signal Error Detected
What Happens?	Phase/signal abnormality detected with a specific target disk
	drive.
What to Do?	Check proper installation of disk drives and contact your RAID
	system supplier.
Message	CHL:_ Drive Channel ALERT: Gross Phase/Signal Error
Event Messages	C-17

	Detected
What Happens?	Phase/signal abnormality detected on the specific drive channel.
What to Do?	Contact your RAID system supplier.
What to Do:	Contact your KAID system supplier.
Message	CHL:_ RCC Channel ALERT: Unexpected Disconnect
- <u>-</u>	Encountered
What Happens?	Unexpected disconnect detected on the specific RCC channel.
What to Do?	Check cabling/termination and canister connections, and contact your RAID system supplier.
Message	CHL:_ID:_ Target ALERT: Unexpected Disconnect Encountered
What Happens?	Unexpected disconnect detected on the specific target disk drive.
What to Do?	Check cabling/termination and canister installation, and contact your RAID system supplier.
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Message	CHL:_ Drive Channel ALERT: Unexpected Disconnect Encountered
What Happens?	Unexpected disconnect detected on the specific drive channel.
What to Do?	Check cabling/termination and canister connections, and contact your RAID system supplier.
Message	CHL:_ RCC Channel ALERT: Timeout Waiting for I/O to Complete
What Happens?	I/O timeout on specific RCC channel.
What to Do?	Contact your RAID system supplier.
D. 4	OUI ID Target ALEDT Three AMARIN of all 10 to Consults
Message	CHL:_ID:_ Target ALERT: Timeout Waiting for I/O to Complete
What Happens?	Drive-side target I/O timeout. Possible drive-side cabling/termination and canister connection abnormal or drive
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	malfunctioning.
What to Do?	Check drive-side cabling/termination/canister/disk drive connections and contact your RAID system supplier.
	J 11
Message	CHL:_ Drive Channel ALERT: Timeout Waiting for I/O to Complete
What Happens?	I/O timeout on specific drive channel.
What to Do?	Contact your RAID system supplier.
N 4	OHI DOO Oharral ALEDT Day 11 (ODO 5 D. 1.1.1
Message	CHL:_ RCC Channel ALERT: Parity/CRC Error Detected
What to De?	RCC channel parity or CRC errors detected.
What to Do?	Rare occurrence of these errors can be managed by firmware. Contact your RAID system supplier.
D. 4	OHI ID Hast Observed ALERT D. W. (2005 - D. C. C.)
Message	CHL:_ID:_ Host Channel ALERT: Parity/CRC Error Detected
What to Do?	Parity or CRC errors detected through host ID, CHL_ID
What to Do?	Occurrences of these faults usually can be negotiated between
	RAID subsystems and application servers. If occurrences
	become frequent, contact your RAID system supplier.

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Message	CHL:_ Drive Channel ALERT: Unit Attention Received (10B)
What Happens?	Drive-side target unit attention received on a drive channel
	CHL:_ ID:
What to Do?	Rare occurrence of these errors can be managed by firmware.
	Check proper installation and contact your RAID system

	supplier.
Message	CHL:_ ID:_ Drive ALERT: Aborted Command (00B)
What Happens?	Aborted command reported from a disk drive CHL:_ ID:_
What to Do?	Rare occurrence of these errors can be managed by firmware.
	Contact your RAID system supplier.
Message	CHL:_ ID:_ Drive ALERT: Unexpected Sense Received (00B)
What Happens?	Drive-side target unexpected sense received on a disk drive
What Happens.	CHL:_ ID:
What to Do?	Check drive-side cabling/installation/working conditions. This
	may result from bad signal quality or poor connection. Contact
	your RAID system supplier.
Message	CHL:_ ID:_ Drive NOTIFY: Block Reassignment Failed – 0(10B)
What Happens?	Data regeneration and reassignment failed.
	The Bad Block Table is full. Too many bad blocks have been
	found on the disk drive.
	The adjacent data blocks on other member drives might have
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	also been damaged.
What to Do?	Rare occurrence of these errors can be managed by firmware.
	Contact your RAID system supplier.
Message	CHL:_ RCC Channel ALERT: Data Overrun/Underrun Detected
What Happens?	Data overrun/underrun errors detected on the RCC channel
	CHL:
What to Do?	Rare occurrence of these errors can be managed by firmware.
	Contact your RAID system supplier.
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Message What Happens?	CHL:_ ID:_ Target ALERT: Data Overrun/Underrun Detected Data overrun/underrun errors detected on a disk drive CHL:_
wriat mapperis:	ID:
What to Do?	Rare occurrence of these errors can be managed by firmware.
	Contact your RAID system supplier.
Message	CHL:_ Drive Channel ALERT: Data Overrun/Underrun
	Detected
What Happens?	Data overrun/underrun errors detected on the drive channel
What to Do?	CHL:
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What to Do? Check proper cabling connection and host HBA, link connection devices, etc. Contact your RAID system supplier.	Message	CHL:_ Host Channel ALERT: Channel Failure
devices, etc. Contact your RAID system supplier.	What Happens?	Host channel CHL:_ link failure or disconnection occurred.
	What to Do?	
Message SMART-Slot:_ Predictable Failure Detected-Clone Failed		devices, etc. Contact your RAID system supplier.
Message SMART-Slot:_ Predictable Failure Detected-Clone Failed		
	Message	SMART-Slot:_ Predictable Failure Detected-Clone Failed

What Happens?	Hard Drive(s) report SMART-detected defects. A spare drive is commenced to clone or replace the member drive showing defects. The cloning operation failed. The member drive suspected of errors might have failed, or the clone process has been interrupted, e.g., yet another member has failed or the spare drive used for cloning has shown immanent faults.
What to Do?	Carefully check drive status and replace the unstable/failed drive. Contact your RAID system supplier.
Message	SMART-Slot:_ Predictable Failure Detected
What Happens?	Hard drive slot:_ reported SMART-detected errors, e.g., abnormal rotation speed, seek time delay, etc.
What to Do?	Carefully check drive status and replace the unstable/failed drive. Contact your RAID system supplier.
Massaga	CMADT Clat. Prodictable Failure Detected Starting Clans
Message What Happens?	SMART-Slot:_ Predictable Failure Detected-Starting Clone One or more hard Drive(s) reports SMART-detected defects. Starts using a pre-defined spare drive to clone the member drive suspected of inherent errors. This happens when SMART detection is enabled with the "Copy & Replace" or "Perpetual Clone" reaction schemes.
What to Do?	Press ESC to clear the message. After the cloning process, you may consider replacing the defective drive with a good one and configure it as a spare drive in case drive failure might happen in the future.
Message	SMART-Slot:_ Predictable Failure Detected (TEST)
What Happens?	This results from a manually executed test command. This ensures your disk drive supports SMART detection and report functionality.
What to Do?	Press ESC to clear the message.
Message	CHL:_ ALERT: Fibre Channel Loop Failure Detected
What Happens?	Fibre Channel loop integrity alert. Lack of bypass or nodes on a loop caused a Fibre loop to fail.
What to Do?	Check host- or drive-side connection. Contact your RAID system supplier.
N 4	OUI ALEDT Deduction to the OUI Edition Detected
Message What Happens?	CHL:_ ALERT: Redundant Loop for CHL:_ Failure Detected One of the dual loop members may have failed or been disconnected. Make sure all channels are properly connected and topological configurations properly set.
What to Do?	Check cabling and system installation. Contact your supplier if no connection errors could be found.
Message	CHL:_ ALERT: Redundant Path for CHL:_ ID:_ Expected but Not Found
What Happens?	One of the dual loop members may have failed or been disconnected. This event is regenerated in the event when the one of dual loop connections to an expansion enclosure can not be found after power-up. Make sure all channels are properly connected and topological configurations properly set.

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What to Do?	Check cabling and system installation. A manual "Issue LIP" command may restore the connection. Contact your supplier if no connection errors could be found.
Message	CHL:_ ID:_ ALERT: Redundant Loop for CHL:_ ID:_ Failure Detected
What Happens?	One of the dual loop members connecting device CHL:_ ID:_ may have failed or been disconnected. Make sure all channels are properly connected and topological configurations properly set.
What to Do?	Check cabling and system installation. Contact your supplier if no connection errors could be found.

C.6.3 Notification:

Message	CHL:_ ID:_ NOTICE: Media Error Recovered-0xD8001C7C
What Happens?	Data once stored on bad drive sectors has been successfully re-conducted from adjacent data blocks/stripes onto the original drive blocks or distributed onto other healthy sectors.
	** RAID, Inc. firmware translates SATA error codes into SCSI standard sense keys and sense codes. That's the error codes at the end of message.
What to Do?	Press ESC to clear the message.
Message	CHL:_ NOTICE: Fibre Channel Loop Connection Restored
What Happens?	Specific Fibre Channel loop connection restored.
What to Do?	Check proper host- or drive-side activities. Press ESC to clear the message.
Message	CHL:_ ID:_ NOTICE: Redundant Path for CHL:_ Restored
What Happens?	Redundant path, one of the drive-side loop members, for CHL:_ ID:_ is restored.
What to Do?	Check proper host- or drive-side activities. Press ESC to clear the message.
Message	CHL:_ NOTICE: Redundant Path for CHL:_ ID:_ Restored
What Happens?	The redundant path (CHL:_) connecting drive (CHL:_ ID:_) is restored.
What to Do?	Check proper host- or drive-side activities. Press ESC to clear the message.
Message	CHL:_ID:_Drive NOTICE: Drive Recovered Error Reported
What Happens?	Hard drive unrecoverable media error reported. A bad block is encountered in the specified hard drive. The RAID controller will ask the hard drive to retry.
What to Do?	Press [ESC] to clear the message.
Message	CHL:_ LIP(FF B) Detected
Event Messages	C-23

What Happens?	A LIP is issued on CHL:
What to Do?	Check proper host- or drive-side activities. Press ESC to clear the
	message.
Message	CHL:_ Host Channel Notification: Bus Reset Issued.
What Happens?	Bus reset on the CHL:_ host channel.
What to Do?	Check proper host- or drive-side activities. Press ESC to clear the message.
Message	CHL:_ ID:_ Drive NOTICE: Scan Drive Successful
What Happens?	A new drive or a replacement drive has been successfully
	scanned/recognized by the subsystem.
What to Do?	Press ESC to clear the message.
	<u> </u>
Message	CHL:_ ID:_ Drive NOTIFY: Block Successfully Reassigned - 0 (10B)
What Happens?	Writes conducted, retried, and media errors were discovered. Writes will then be re-directed to other drive sectors.
What to Do?	Press ESC to clear the message. If this message becomes
	frequent, the target disk drive might have developed serious media errors.
Message	CHL:_ID_ Drive #SEV#: Media Error Encountered
What Happens?	Media errors are encountered in a hard drive.
What to Do?	Press ESC to clear the message. If this message becomes
	frequent, the target disk drive might have developed serious
	media errors.

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C.7 General Target Events

C.7.1 Critical:

Message	SAF-TE Device(0) ALERT: Power Supply Failure
	Detected(Idx:132)
What Happens?	Power supply failure detected through SAF-TE monitoring device.
What to Do?	Contact your RAID supplier for a replacement module.
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Message	Peripheral Set 0 Device ALERT: Power Supply 0 Failure Detected
What Happens?	Power supply failure detected through an I2C serial bus.
What to Do?	Contact your RAID supplier for a replacement module.
Message	Peripheral Set 0 Device ALERT: Power Supply 0 Not Present
What Happens?	No power supply module is installed in the expected module slot.
What to Do?	Check proper module installation. If an installed module can not be detected, contact your RAID supplier.
Message	Peripheral Set 0 Device ALERT: Low Voltage Detected (-1073939240.5V)
What Happens?	Low voltage detected from the power supply. Power supply may have become unstable.
What to Do?	Check proper module installation and contact your RAID supplier for a replacement module.
	supplier for a replacement module.
Message	SES(C0 I0)Power Supply 0:Device Not Supported!
What Happens?	Unrecognizable device type. This event may result from an
What Happens.	incorrect configuration with the SES remote device monitoring.
What to Do?	Check proper module installation and contact your RAID system supplier.
Message	SAF-TE Device(0) ALERT: Cooling Fan Not Installed(Idx:2)
What Happens?	No cooling fan module is installed in the expected module slot.
What to Do?	Check proper module installation. If an installed module can not
	be detected, contact your RAID supplier.
Message	SAF-TE Device(0) ALERT: Cooling Fan Failure Detected(Idx:2)
What Happens?	Cooling fan failure detected through SAF-TE monitoring device.
What to Do?	Contact your RAID supplier for a replacement module.
Message	Peripheral Set 0 Device ALERT: Cooling Fan 2 Failure Detected
What Happens?	Cooling fan failure detected through an I2C serial bus.
What to Do?	Contact your RAID supplier for a replacement module.

Message Peripheral Set 0 Device ALERT: Cooling Fan 2 Note Present What to Do? Check proper module is installation or contact your RAID supplier for a replacement module. Message Peripheral Set 0 Device ALERT: Low Speed Detected(-1073870808 RPM) What Happens? Low rotation speed detected on cooling fan. This is a fault detected through an I2C serial bus. What to Do? Check proper module installation or contact your RAID supplier for a replacement module. Message SES(CO I0)Cooling Fan 0:Device Not Supported! What Happens? Unrecognizable device type. This event may result from an incorrect configuration with the SES remote device monitoring. What to Do? Check proper module installation and contact your RAID system supplier. Message SAF-TE Device(0) ALERT: Elevated Temperature Alert Elevated temperature detected through SAF-TE monitoring device. Improper installation site condition or cooling fan failure might have caused the system temperature to rise. What to Do? Check proper cooling and cooling fan working condition. Contact your RAID system supplier. Message Peripheral Device ALERT: CPU Cold Temperature Detected		
What Happens? No cooling fan module is installed in the expected module slot. Check proper module installation or contact your RAID supplier for a replacement module. Message Peripheral Set 0 Device ALERT: Low Speed Detected(-1073870808 RPM) What Happens? Low rotation speed detected on cooling fan. This is a fault detected through an I2C serial bus. What to Do? Check proper module installation or contact your RAID supplier for a replacement module. Message SES(C0 I0)Cooling Fan 0:Device Not Supported! What Happens? Unrecognizable device type. This event may result from an incorrect configuration with the SES remote device monitoring. What to Do? Check proper module installation and contact your RAID system supplier. Message SAF-TE Device(0) ALERT: Elevated Temperature Alert Elevated temperature detected through SAF-TE monitoring device. Improper installation site condition or cooling fan failure might have caused the system temperature to rise. What to Do? Check proper cooling and cooling fan working condition. Contact your RAID system supplier. Message Peripheral Device ALERT: CPU Cold Temperature Detected(C)) What Happens? Temperature below the lower CPU threshold detected. Improper installation site condition might have caused the situation. What to Do? Correct your installation site condition. Contact your RAID system supplier. Message Peripheral Device ALERT: Elevated Temperature Alert What Happens? High temperature threshold violated and detected through an 12C serial bus. Improper installation site condition or cooling fan failure might have caused the situation. What to Do? Correct your installation site condition and cooling fan failure. Contact your RAID system supplier if a replacement is necessary. Message Peripheral Set 0 Device ALERT: Temperature Sensor 0 Failure Detected What Happens? Temperature sensor failure reported through an 12C serial bus.	Message	Peripheral Set 0 Device ALERT: Cooling Fan 2 Note Present
What to Do? Check proper module installation or contact your RAID supplier for a replacement module. Message Peripheral Set 0 Device ALERT: Low Speed Detected(-1073870808 RPM) What Happens? Low rotation speed detected on cooling fan. This is a fault detected through an I2C serial bus. What to Do? Check proper module installation or contact your RAID supplier for a replacement module. Message SES(C0 10)Cooling Fan 0:Device Not Supported! What Happens? Unrecognizable device type. This event may result from an incorrect configuration with the SES remote device monitoring. What to Do? Check proper module installation and contact your RAID system supplier. Message SAF-TE Device(0) ALERT: Elevated Temperature Alert Elevated temperature detected through SAF-TE monitoring device. Improper installation site condition or cooling fan failure might have caused the system temperature to rise. Check proper cooling and cooling fan working condition. Contact your RAID system supplier. Message Peripheral Device ALERT: CPU Cold Temperature Detected(C) What Happens? Temperature below the lower CPU threshold detected. Improper installation site condition might have caused the situation. What to Do? Correct your installation site condition. Contact your RAID system supplier. Message Peripheral Device ALERT: Elevated Temperature Alert What Happens? High temperature threshold violated and detected through an 12C serial bus. Improper installation site condition or cooling fan failure might have caused the situation. Correct your installation site condition and cooling fan failure. Contact your RAID system supplier if a replacement is necessary. Message Peripheral Set 0 Device ALERT: Temperature Sensor 0 Failure Detected Temperature sensor failure reported through an 12C serial bus.	What Happens?	No cooling fan module is installed in the expected module slot.
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C-26 RAID, Inc.

Message	Peripheral Set 0 Device ALERT: Temperature Sensor 0 Not Present
What Happens?	Temperature sensor failed or serial bus
	configuration/connection faults occurred.
What to Do?	Contact your RAID system supplier.
Message	Peripheral Set 0 Device ALERT: Cold Detected
What Happens?	Temperature dropped below the lower system threshold
	detected. Improper installation site condition might have
	caused the situation.
What to Do?	Correct your installation site condition. Contact your RAID
	system supplier.
Message	SES(C0 I0)Temp Sensor 0: Device Note Supported!
What Happens?	Unrecognizable device type. This event may result from an
	incorrect configuration with the SES remote device monitoring.
What to Do?	Check proper module installation and contact your RAID system
	supplier.
Message	UPS Connection Is Absent
What Happens?	The COM2 link to a UPS device is absent.
What to Do?	Check cabling to the UPS device. If hardware faults occurred,
	contact your RAID system supplier.
Message	SAF-TE Device(2) ALERT: UPS Power Failure Detected
What Happens?	UPS power failure detected through SAF-TE monitoring device.
What to Do?	Contact your UPS supplier.
Message	Peripheral Set 0 Device ALERT: UPS Power Failure Detected
What Happens?	UPS power failure is detected through an I2C serial bus.
What to Do?	Contact your RAID system supplier.
Message	Peripheral Set 0 Device ALERT: UPS 2 AC Power Failure
	Detected
What Happens?	AC power source failure reported by UPS and to the subsystem
	firmware through an I2C serial bus.
What to Do?	Check your power source connection or contact your RAID
	system supplier.
Message	Peripheral Set 0 Device ALERT: UPS 2 Battery Failure Detected
What Happens?	UPS battery failure reported by UPS and to the subsystem
	firmware through an I2C serial bus.
What to Do?	Contact your UPS supplier.

Massaga	Warning, LIDC AC Dower Loss Detected
Message	Warning: UPS AC Power-Loss Detected
What Happens?	UPS AC power loss reported through the COM2 serial port
	connection.
What to Do?	Contact your UPS supplier.
Message	Warning: UPS Battery Low%
What Happens?	UPS battery charge low, may not be able to support subsystem
	during a power outage.
What to Do?	Wait for the UPS to recharge or you may use the Event Triggered
	mechanisms implemented with firmware. These mechanisms
	use conservative operation modes to reduce the chance of data
	loss in the event of power outage. Contact your UPS supplier.
Message	SES(C0 I0)UPS 2: Device Not Supported!
What Happens?	Unrecognizable device type. This event may result from an
	incorrect configuration with the SES remote device monitoring.
What to Do?	Check proper module installation and contact your RAID system
	supplier.

C.7.2 Notification:

Message	SAF-TE Device(2) NOTICE: Fan Back On-Line(Idx:11)
What Happens?	A once missing or failed cooling fan is restored. This message is
	reported through the SAF_TE monitoring device.
What to Do?	Press ESC to clear this message.
Message	NOTICE: Fan Module A Back On-Line(FAN0 _RPM)
What Happens?	A once missing or failed cooling fan is restored. This message is
	reported through an I2C serial bus with RPM reading.
What to Do?	Press ESC to clear this message.
Message	Peripheral Device NOTICE: Fan Back On-Line
What Happens?	An I2C serial bus message indicating a once missing or failed
	cooling fan is restored.
What to Do?	Press ESC to clear this message.
Message	Peripheral Set 0 Device NOTICE: FAN 1 Back On-Line
What Happens?	An individual cooling fan once missing or failed is restored.
What to Do?	Press ESC to clear this message.
Message	Peripheral Set 0 Device NOTICE: FAN 1 is Present
What Happens?	An individual cooling fan once missing or failed is restored.
What to Do?	Press ESC to clear this message.

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Message	Peripheral Set 0 Device NOTICE: FAN 1 Back On-Line(_RPM)
What Happens?	An individual cooling fan once missing or failed is restored, and
	the PRM reading displays. This applies to enclosure
	implementations using cooling fans capable of reporting rotation
	speed.
What to Do?	Press ESC to clear this message.
	J
Message	SES(C0 I0) Cooling Fan 1:Fan Back On-Line
What Happens?	A cooling fan once missing or failed is restored. This message is
ттат парропот	reported through an SES monitoring device.
What to Do?	Press ESC to clear this message.
Message	Peripheral Set 0 Device NOTICE: FAN 1 Back On-Line
What Happens?	An individual cooling fan once missing or failed is restored.
What to Do?	Press ESC to clear this message.
	<u> </u>
Message	SAF-TE Device(1) NOTICE: Temperature Back To Non-Critical
	LVs
What Happens?	Operating temperature back within normal temperature range.
What to Do?	Press ESC to clear this message.
Message	Peripheral Set 0 Device NOTICE: Temperature 1 Back To
	Non-Critical LVs
What Happens?	Temperature sensor 1 reports operating temperature is now
	within normal temperature range.
What to Do?	Press ESC to clear this message.
Message	Peripheral Set 0 Device NOTICE: Temperature 1 is Present
What Happens?	Temperature sensor 1 once missing and is now present on the
	serial bus.
What to Do?	Press ESC to clear this message.
Message	Peripheral Set 0 Device NOTICE: Temperature 1 Back To
	Non-Critical LVs (_(C)
What Happens?	Temperature sensor 1 reports operating temperature is now
	within normal temperature range and the Celsius reading
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	displays.
What to Do?	Press ESC to clear this message.
Message	SES(C0 I0) Temp Sensor 1: Temperature Back to Non Critical LVs
What Happens?	Temperature sensor 1 reports operating temperature is now
\\/\batta	within normal temperature range.
What to Do?	Press ESC to clear this message.
	CAFTED 1 (A) MOTIOF D 2 1 D 1 O 11 (11 11)
Message	SAF-TE Device(1) NOTICE: Power Supply Back On-Line (Idx:4)
What Happens?	A power supply once missing or failed is now restored. This
What to Do2	event is reported through the SAF-TE monitoring interface.
What to Do?	Press ESC to clear this message.

Message	Power Supply 0 Back-Online
What Happens?	Power supply module 0 is back online
What to Do?	Press ESC to clear this message.
	<u> </u>
Message	Peripheral Set 0 Device NOTICE: PSU0 +12V Back On-Line
What Happens?	Power supply module 0 restored normal +12V voltage range
What to Do?	Press ESC to clear this message.
Message	Peripheral Set 0 Device NOTICE: PSU0 +12V is Present
What Happens?	Power supply module 0 restored normal +12V voltage range
What to Do?	Press ESC to clear this message.
Message	SES(C0 I0)Power Supply 2: Power Supply Back On-Line
What Happens?	Power supply module 2 once missing or failed is now restored.
What to Do?	Press ESC to clear this message.
Message	UPS Connection Detected
What Happens?	The COM2 serial link to UPS device is now valid.
What to Do?	Press ESC to clear this message.
Message	UPS AC Power Restored
What Happens?	UPS reports AC power source is now restored.
What to Do?	Press ESC to clear this message.
	<u> </u>
Message	UPS Battery Restored to Safe Level 0
What Happens?	UPS battery is charged to a safe level, able to protect system
	operation.
What to Do?	Press ESC to clear this message.
Message	SAF-TE Device(2) NOTICE: UPS Power Back On-Line
What Happens?	Power supplied by UPS is now restored.
What to Do?	Press ESC to clear this message.
Message	Peripheral Set 0 Device NOTICE: UPS 2 AC Power Back On-Line
What Happens?	UPS 2 AC power source restored.
What to Do?	Press ESC to clear this message.
	-
Message	Peripheral Set 0 Device NOTICE: UPS 2 Battery Back On-Line
What Happens?	UPS 2 Battery charge or battery failure restored.
What to Do?	Press ESC to clear this message.
	<u> </u>
Message	Peripheral Set 0 Device NOTICE: UPS 2 AC Power Back On-Line
What Happens?	UPS 2 AC power source restored.
What to Do?	•
vvnar to Doz	Press ESC to clear this message.

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Message	SES(C0 I0)UPS 2: UPS Power Back On-Line
What Happens?	UPS 2 connected through SES interface reports power back
	online.
What to Do?	Press ESC to clear this message.

C.8 Controller Events

C.8.1 Critical:

Message	ALERT: +3.3V Low Voltage Detected(V)
What Happens?	The detected +3.3V voltage source is lower than the preset
	voltage threshold.
What to Do?	Check power supply working condition, voltage threshold
	settings, and contact your RAID system supplier if necessary.
	<u> </u>
Message	ALERT: Controller FAN 0 Low Speed Detected (_RPM)
What Happens?	This only applies to controller fans in the SentinelRAID series.
	Low rotation speed detected.
What to Do?	Contact your RAID system supplier for a replacement.
Message	Controller NOTICE: Redundant Controller Firmware Updated
What Happens?	Firmware updated on a redundant controller RAID subsystem.
	Resetting the subsystem may be required for the new firmware
	to take effect.
What to Do?	Updating firmware on a complex system configuration is
	recommended for experienced engineers only. Unless for bug
	fixing, updating firmware is not always necessary.
Message	Controller ALERT: Redundant Controller Failure Detected
What Happens?	One RAID controller in a controller pair failed. This message
	indicates that its partner has taken the workload and managed
	the failover operation.
What to Do?	Contact your RAID system supplier for a replacement controller
	and restore the dual-active configuration.
Message	Controller SDRAM ECC Multi-bits Errors Detected
What Happens?	Memory multi-bits errors.
What to Do?	Contact your RAID system supplier to return the
	subsystem/RAID controller for repair.
	<u> </u>
Message	Controller SDRAM ECC Single-bit Errors Detected
What Happens?	Memory single-bit errors.
What to Do?	Subsystem firmware should be able to manage the single-bit
	errors. Contact your RAID system supplier if this message
	becomes frequent.
	<u> </u>

Message	Controller SDRAM Parity Errors Detected
What Happens?	Memory parity errors.
What to Do?	Subsystem firmware should be able to manage the parity errors in memory. Contact your RAID system supplier if this message becomes frequent.
Message	Controller PCI Bus Parity Errors Detected
What Happens?	Serious system faults have occurred.
What to Do?	Stop host I/Os immediately to prevent further data dis-integrity and contact your RAID system supplier.
Message What Happens?	Controller ALERT: Power Supply Unstable or NVRAM Failed Power supply voltage fluctuating or internal system faults have occurred. Different system faults may trigger this event, e.g., memory pins contact problems or incongruent firmware versions, etc.
What to Do?	Check proper system operation conditions and contact your RAID system supplier.
Message	BBU Absent or Failed! Correct It and Reset Ctlr to Take Effect
What Happens?	BBU (battery cell pack) has failed or is accidentally removed. When a new module is installed, reset the subsystem for the configuration to take effect.
What to Do?	Check proper installation of the module or contact your RAID system supplier for a replacement module.
N 4	Operator Ham DDH. Alternation Felled
Message What Happens?	Controller BBU Absent or Failed! BBU (battery cell pack) has failed or is accidentally removed.
what happens:	When a new module is installed, reset the subsystem for the configuration to take effect.
What to Do?	Check proper installation of the module or contact your RAID system supplier for a replacement module.
	0 1 11 00115 11 0 1 1 1
Message What Happans?	Controller BBU Failure Detected!
What Happens?	BBU (battery cell pack) has failed or is accidentally removed. When a new module is installed, reset the subsystem for the configuration to take effect.
What to Do?	Check proper installation of the module or contact your RAID system supplier for a replacement module.

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Message	Controller BBU Thermal Shutdown/Enter Sleep-Mode!
What Happens?	The following conditions will cause the charger circuits to enter a low-power and self-protection state: 1. The temperature sensor on the charger circuit reports elevated temperature reading (>= 45 degree Celsius).
	The BBU (battery cell pack) has been charged for over 7 hours. The BBU charger will enter a timer fault state.
What to Do?	 Check proper ventilation within the subsystem. You may also check the readings from other sensors within the enclosure. Airflow might have been disrupted by the absence of one or several major modules or the failure of a cooling fan. Once the thermal condition is improved, charging will resume automatically.
	2. If a new battery module has been charged for over seven (7) hours and this event is issued, you may remove and re-install the battery module. An empty battery module may take more than 7 hours to be fully charged. There is a timer embedded with the charger, doing so can reset the timer. Charging will resume automatically.

C.8.2 Warning:

Message	Memory Not Sufficient to Fully Support Current Config.
What Happens?	The installed memory size does not support current
	configuration. Try using a DIMM module of a larger size.
What to Do?	Check proper installation of the module or contact your RAID
	system supplier for a certified module.

C.8.3 Notification:

Message	Board1 Cold Temperature Back to Non-Critical LVs(_(C))
What Happens?	Board1 (usually the RAID controller main board) ventilation
	condition is restored to normal.
What to Do?	Check proper working condition and press ESC to clear the
	message.
Message	+12V Upper Voltage Back within Acceptable Limits (V)
What Happens?	+12V voltage dropped back within preset thresholds.
What to Do?	Check proper working condition and press ESC to clear the
	message.

Message	+12V Lower Voltage Back within Acceptable Limits (V)
What Happens?	+12V voltage dropped back within preset thresholds.
What to Do?	Check proper working condition and press ESC to clear the
	message.
Message	Memory is Now Sufficient to Fully Support Current Config.
What Happens?	Memory of a sufficient capacity is installed and the subsystem
	should work properly.
What to Do?	Check proper working condition and press ESC to clear the
	message.
Message	Controller NOTICE: NVRAM Factory Defaults Restored
What Happens?	The factory defaults for configuration profile is restored.
What to Do?	Press ESC to clear the message.
Message	Controller BBU is Charging!
What Happens?	Once a new BBU is installed or BBU charge drops below a
wriat i iapperis:	preconfigured level, the subsystem will start charging its
	batteries.
What to Do?	Press ESC to clear the message. All batteries have a limited life
What to Do:	<u> </u>
	expectancy. If this message appears too frequently, the BBU may
	have gradually lost its ability to hold charge.
Message	+12V Upper Voltage Back within Acceptable Limits (V)
What Happens?	+12V oltage dropped back within preset thresholds.
What to Do?	Check proper working condition and press ESC to clear the
What to Do:	message.
Message	NOTICE: Controller BBU Present!
What Happens?	A BBU once missing or removed is now electrically connected to
	the subsystem.
What to Do?	Check proper working condition and press ESC to clear the
	message.
Message	NOTICE: Controller BBU Back On-Line!
Message What Happens?	A BBU once missing or removed is now restored to its normal
What Happens?	A BBU once missing or removed is now restored to its normal working condition.
	A BBU once missing or removed is now restored to its normal
What Happens?	A BBU once missing or removed is now restored to its normal working condition. Check proper working condition and press ESC to clear the
What Happens? What to Do? Message	A BBU once missing or removed is now restored to its normal working condition. Check proper working condition and press ESC to clear the
What Happens? What to Do?	A BBU once missing or removed is now restored to its normal working condition. Check proper working condition and press ESC to clear the message. NOTICE: Controller BBU Fully Charged! A BBU is fully charged.
What Happens? What to Do? Message	A BBU once missing or removed is now restored to its normal working condition. Check proper working condition and press ESC to clear the message. NOTICE: Controller BBU Fully Charged!

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Message	Force Controller Write-Through on Trigger Cause
What Happens?	Preset conditions, e.g., elevated temperature or component
	failure, has forced the subsystem to adopt a more conservative
	operating mode by disabling the Write-Back caching.
What to Do?	Check proper working condition and correct system faults. Press
	ESC to clear the message.

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